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American Electroplaters' Society Concludes Good Convention at Philadelphia

By Dr. A. K. GRAHAM

Associate Editor

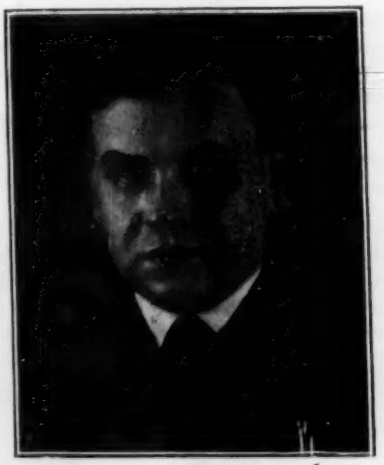
Sessions Prove Highly Educational—Social Features Much Appreciated — C. A. Van Derau Elected President for 1932-33 — Chicago Selected for Next Year's Convention

THE TWENTIETH ANNUAL CONVENTION of the American Electroplaters' Society is now past, but those who travelled to Philadelphia to attend this function are not likely to forget its many enjoyable features. The educational program was unanimously acclaimed as one of the best the Society has ever offered. The industrial trips were of sufficient variety and interest to satisfy all who cared to take them, and the social features were everything that could be desired. In fact, the only thing that made this convention compare unfavorably with the best that have been given in the past was the reduced attendance. But in view of present conditions, a registration of 287, including about 40 ladies, is exceedingly good.

Monday Educational Session

The chairman of the Monday meeting, Dr. H. S. Lukens of the University of Pennsylvania, is to be congratulated on arranging an unusually interesting program. The papers presented were as follows:

Electrodeposition of Tungsten from Alkaline Solutions, by Dr. Louis Kahlenberg and M. L. Holt of the University of Wisconsin, very ably presented by Dr. Harry H. Alsentzer of the University of Pennsylvania. Dr. Alsentzer clearly explained the numerous results obtained by the authors from fused electrolytes, non-aqueous electrolytes and aqueous electrolytes. Only in the case of aqueous electrolytes was any success experienced, and the best results were obtained with a concentrated sodium phosphate (Na_3PO_4), tungstic oxide (WO_3), water solution. A current density of 9 amp/dm-^{2} at 90° C gave the best deposit. Other variables studied were the composition of the base metal; pH of the bath; and the effect of ammonia additions. In conclusion, Dr. Alsentzer emphasized that the problem of tungsten plating was a most difficult one, about which there remains much to be learned.



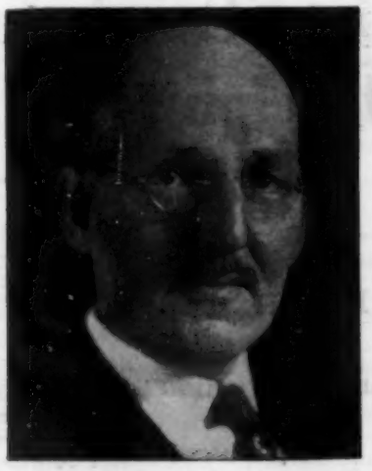
C. A. VAN DERAU
Elected President
of the American
Electroplaters' Society
for 1932-1933

Dr. E. A. Vueillenmier of Dickinson College presented a very interesting review of his work on the use of the contractometer in the study of the peeling of nickel deposits. The discussion was quite animated, and emphasized the fact that both iron and

hydrogen cause strains in nickel deposits. Whether peeling results depends upon the perfectness of the bond to the base metal.

Review of the Recent Foreign Literature, prepared by Dr. M. deKay Thompson of the Massachusetts Institute of Technology. In discussion it was suggested that an annual review of the foreign literature could appropriately be prepared by some competent person for each convention.

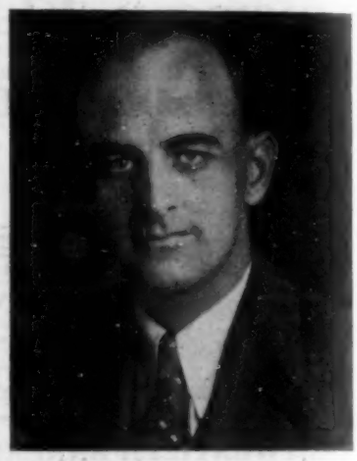
A Study of Base Metals in Industrial Chromium Plating Applications, by Lt. Arthur Willink was presented in the author's absence by Dr. A. K. Graham. In this paper the effect of the applied force, the yield point of the base metal, and the temperature of the operation were discussed as they affect the use of chromium on dies. It was stated that failure of chromium in most cases was due to deformation of the base metal beyond its elastic limits and not to the chromium plating.



Co - Authors of a Paper Presented at the Convention

Left—GEORGE B. HOGABOOM, of Hanson-Van Winkle-Munning Company, Matawan, N. J.

Right—Dr. A. K. GRAHAM, of the University of Pennsylvania, Philadelphia, Pa.



Free Cyanide in Brass Plating Baths by Dr. L. C. Pan. An interesting paper which created considerable discussion. While the determination of free cyanide in a brass solution is not possible with great precision, it was possible for the author to demonstrate that the metal cyanide complexes in the brass bath were $NaCn(CN)_2$ and $NaZn(CN)_3$.

The Decomposition of Cyanide Solutions, by R. M. Wick of the Bureau of Standards. This paper discussed the following reaction involved in the chemical decomposition of potassium cyanide:

1 $KCN + H_2O \longrightarrow KOH + HCN$
2 $2KOH + CO_2 \longrightarrow K_2CO_3 + H_2O$
3 $KCN + 2H_2O \longrightarrow HCOOK + NH_3$

While it is recognized that the presence of complex metal cyanides and electrochemical effects will greatly influence the decomposition of cyanide in a plating bath, yet it is possible to state that high temperatures increase decomposition by reactions 1 and 3 while air agitation or excessive stirring will increase decomposition by reaction 2.

Tuesday—Symposium on Zinc Plating

Plating Zinc Base Die Castings, by R. J. Wirshing, **Plating on Zinc,** by W. M. Pierce.

These papers were discussed jointly. In plating on die castings, the value of double deposits was discussed, the criterion by which they should be judged being freedom from porosity. When plating zinc, a deposit of 0.0003 to 0.0005 inch of nickel were recommended. The importance of joint outdoor exposure and salt spray tests in evaluating such deposits was emphasized.

Electroplating of Zinc in Aluminum, by Dr. Harold K. Work. He showed that while zinc plated from a cyanide electrolyte containing NH_4OH instead of NaOH gave very satisfactory protection to high tensile aluminum alloys in salt spray, the superior resistance of aluminum clad alloys made the use of zinc coatings unnecssary.

Anodes for Zinc Plating, by Dr. A. K. Graham and George B. Hogaboom. The properties of a 0.5 percent aluminum 0.3 percent mercury-zinc anode were studied in both acid and cyanide baths. By comparison with cast anodes of Horse Head zinc, 0.3 percent mercury-zinc and up to 0.75 percent aluminum-zinc, the new anodes were shown to be sludge free and of excellent character with respect to current efficiency, solution maintenance and polarization. In 48 hour runs in acid baths the pH varied only 0.1 pH unit with no addition of acid when using a 0.5 percent aluminum-mercury-zinc anode.

Barrel Plating with Particular Reference to Optimum Loads and Costs, by Gustaf Soderberg.

Barrel Plating with Duo-Zinc, by F. F. Oplinger.

Both of these papers contained an immense amount of information of practical value to the plater and are worthy of a most detailed study as soon as they become available.

Wednesday Session

At the Wednesday morning educational session, Mr. S. T. Lumbeck presided.

Papers: **Anodic Deposition of Rubber,** by Albert Hirsh of the Philadelphia Branch.

Finishing Steel Products by the Use of Sand, Shavings, Soap-Suds and Steel Balls, by Walter S. Barrows of the Toronto Branch. The papers were well received.

Determination of Hydrogen Ion Concentration, by Dr. E. Sanigar. A most interesting discussion.

Aluminite, by H. Bengston and R. E. Petit. A very complete review of the uses of the "Aluminite" process for decorative and protective purposes. All who heard this paper and observed the elaborate display of Aluminum Colors, Inc., will testify to the remarkable progress that has been made in this field.

Papers by Mr. Hayden of the Stanley Chemical Company and Mr. Longnecker of the Zapon Company

on developments in lacquers contained a wealth of information of value to those using lacquers and should be read by all interested in such material.

Thursday Morning

Summary of Researches on Plating at the Bureau of Standards, by Dr. William Blum.

Progress Report on Exposure Tests and Accelerated Tests of Plated Castings, by Dr. William Blum, at the Bureau of Standards.

Experiences in the Preparation of Specimens for Exposure Tests, by P. W. C. Strausser, Research Associate of the American Electroplaters' Society.

All three of the above papers created much interesting discussion, reflecting in part the interest which the industry at large has in the activities of the Bureau of Standards.

J. Hay reported for the Research Committee, and Albert Hirsch for the Educational Committee.

Paper Awards

The Prize Award Committee were unable to make an award because no active members had contributed papers which were deserving of the honor. The following associate members were given honorary mention for their contributions to the Review:

W. M. Phillips for his papers on "Low pH Nickel Solutions" and "Pitting of Nickel."

Gustaf Soderberg for a paper on "Anode Phenomena in Cadmium Plating Solutions."

George Dubpernell for a paper on "Causes of Adhesion of Electrodeposits."

George B. Hogaboom for his paper on "Electroplating on Cold Rolled Steel."

Authors of Papers Presented at the Convention

Left—Dr. WILLIAM BLUM, of the Bureau of Standards, Washington, D. C.

Right—W. S. BARROWS, of the Toronto Branch, American Electroplaters' Society.

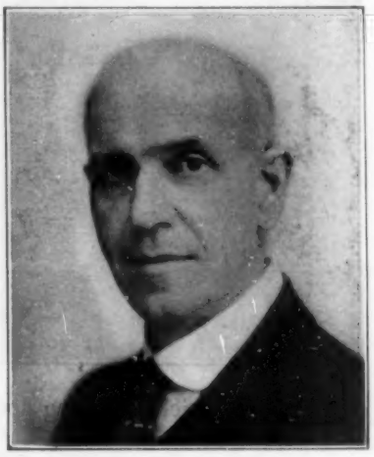


Exhibit Award

The Exhibit Committee awarded the First Prize Certificate to W. W. Feltin of the Samson United Company of Rochester, N. Y., for his excellent display.

Plant Visits

A large number of industrial trips were arranged but the members limited their interest to the R C A-Victor plant in Camden, the Philadelphia Storage Battery Company, The Royal Electrotype Company,

Members and Guests of the American Electroplaters' Society Assembled at the Annual Banquet

and the Naval Aircraft Factory. The convention owes a debt of gratitude to the other plants which extended invitations to visit them.

Entertainment

The International Fellowship Club's "Open House" at the Elks Club on Monday evening was acclaimed as a huge success. With both the ladies and men attending the orchestra, facilities for dancing, refreshments and sociability were enjoyed to the full. Numerous prizes which had been donated were awarded to those holding lucky numbers, and $100.00 was raised and donated to the research fund.

Banquet

Nearly 300 attended the Annual Banquet which was held in the large ball room of the Benjamin Franklin Hotel. It was featured by an excellent menu, good music, dancing and unusual favors.

Annual Business Meeting

At the annual business meeting on Thursday afternoon, the delegates voted to publish the "Review" quarterly instead of monthly, in order to reduce expenses, but advertising in the "Review" was not favored. A number of changes were also made in the constitution and by-laws.

Chicago for 1933 Convention

Chicago was chosen as the convention city for 1933. The Exposition of a Century of Progress will be held there at the same time.

H. A. GILBERTSON
Re-elected
Editor of the
Monthly Review

W. J. R. KENNEDY
Re-elected
Editor of the
Monthly Review

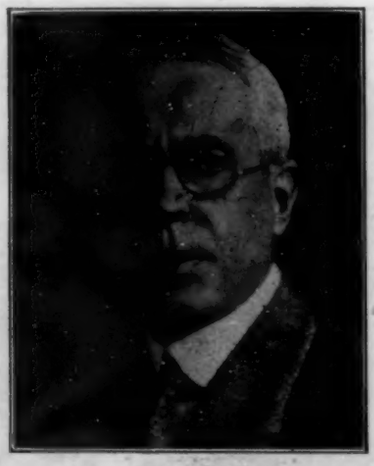
Officers for 1932-1933

The following officers were elected for the coming year:

C. Van Dereau, Dayton Branch ..... President
T. F. Slattery, Baltimore Branch.....First Vice-President.
Steen Thompson, Cleveland Branch.....Second Vice-President.
H. A. Gilberson, Chicago Branch ..... Secretary-Treasurer.
William J. R. Kennedy, Hartford, Conn., Valley Branch ..... Editor of the "Review"

Officers of the International Fellowship Club for 1932-33

W. L. CASSELL
Vice-Chairman



N. P. HUNTER
President

T. A. TRUMBOUR
Secretary-Treasurer

International Fellowship Club

The International Fellowship Club, as in former years, gathered at the convention and held its annual meeting there. It held "Open House" at the Elks Club in Philadelphia the first night of the convention. This was a highly successful affair, stimulating sociability among the visiting platers and guests, and generally giving the convention a fine start. The Club was warmly congratulated on its fine spirit in this connection.

The annual meeting was held Tuesday, June 21. Various matters were discussed, including plans for the Club's attendance and activity at the 1933 convention of the American Electroplaters' Society, which will take place at Chicago.

The following officers were elected for the 1932-1933 year by the International Fellowship Club:

President, N. P. Hunter, Chicago representative of the Egyptian Lacquer Manufacturing Company, New York. Mr. Hunter formerly was vice-chairman.

Vice-Chairman, W. L. Cassell, New York representative of the Udylite Process Company, Detroit, Mich.

Secretary-Treasurer, Thomas A. Trumbour, Business Manager of METAL INDUSTRY, New York. (Re-elected.)

Hot Dip Cadmium

Q.—We are very much interested in securing all the information available relative to plating of wire with cadmium. This applies particularly to plating the same by the hot method—not electrolytic.

A.—There is little or nothing in the literature on the hot dip method of cadmium coating. A number of references on it fail to reveal any real practical information of value to the man who wants to do it. In view of this fact some suggestions which may help out will perhaps be worth trying as they are based on good scientific reasons for proceeding as suggested. A few scientific facts are of interest first, and these are given below.

The metal cadmium has an atomic weight of 112.409; its valency is 2; its specific gravity is (cast) 8.604; its specific heat is 0.0576; its latent heat of fusion 13; its melting point 320 degrees C.; its hardness (annealed) 21.3-25.5 Brinell scale; its coefficient of expansion is 0.0000306 linear, 0-100 degrees C.; its tensile strength is 13,660 pounds per sq. in.

The best method of cadmium coating by the hot dip process would seem to be through the medium of zinc. Very little is known of the cadmium iron series of alloys. Hence, since the general practice of hot dip galvanizing is understood it would seem that the approach to a satisfactory cadmium coating by the same method should be through zinc or tin alloys with cadmium, as both of these metals readily unite with iron and are used as coatings.

Since zinc is the best known metal for protective coatings the logical method of approach would seem to dissolve up, or melt up some slab zinc on the basis of first 5 pounds to the 100; that is cadmium 95 pounds, zinc 5 pounds; and then either increase or decrease the amount according to results obtained. The zinc would give the bond, the same as in hot galvanizing, and the cadmium would then give the body of the coating alloyed to the zinc. The question of peeling and flaking at once comes to mind, as that much zinc may make the cadmium brittle. If so, then the amount should be decreased. A small amount of lead, the same as in the pot in galvanizing should also help to overcome brittleness if it does develop.

The flux should be the same about as in galvanizing, liquid zinc chloride in which there is some ammonium chloride dissolved. The relation should perhaps be about 80 to 85% of zinc chloride and 20 to 15% of ammonium chloride. This should be used as a liquid flux, and the same flux used on the bath. Cadmium oxidizes at approximately 260 degrees C. (about 500 degrees F.) the surface first changing to a straw color and then to a brown. To prevent this oxidation of the bath a little aluminum might be added, the same as is done in galvanizing. Aluminum and cadmium are entirely insoluble in each other, but with a small amount of zinc present, the bath may take up enough aluminum to overcome the oxidation. The operating temperature of the bath will probably have to be about 640-650 degrees F.

—WALLACE IMHOFF.

Aluminum-Copper Alloys

Q. Would you kindly give me some information on an aluminum and copper alloy, consisting of 50% aluminum with a melting point of 1214 and 50% copper with a melting point of 1943.

If these two metals are alloyed as stated above, what will be the melting point of the alloy on remelting. Will it be greater or lower than the melting point of aluminum? If it is lower, why does this take place?

A.—The melting point of an alloy containing 50% copper, 50% aluminum is approximately 1112 deg. F., 100 deg. F. or more below the melting point of pure aluminum. At this point the alloy consists almost wholly of a compound of copper and aluminum, containing one molecular portion of copper, two of aluminum. This compound has properties entirely different from those of either of the parent metals; among other things a much lower melting point. Incidentally the melting point of copper is 1983 deg. F., **not** 1943 deg. F. Alloys in the molten state commonly exist in the form of a solution of one metal in the other, similar to a solution of salt in water, and alloys which have a melting point lower than that of either parent metal are very common, just as salt brine has a freezing point lower than that of water.

The 50-50 copper aluminum alloy is very brittle and has no useful mechanical properties. It is used in foundry work, under the name of "hardener" as a convenient means for introducing aluminum into a copper alloy or copper into aluminum alloy.

— H. M. ST. JOHN

Exposure Tests on Plated Metals

A Report on the Preparation of Specimens for Exposure Tests of Electroplated Coatings on Steel—Conclusion*

By the Joint Committee of American Electroplaters' Society, American Society for Testing Materials and the Bureau of Standards

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, MAY, 1932

5. Conditions for Zinc Plating:

Cast zinc anodes were used. The operating conditions were as follows:

N—Cyanide Bath—Standard—

Solution Formula

	N	g/l	oz/gal
Zinc cyanide, $Zn(CN)_2$	1.0	60	8
Sodium cyanide, NaCN	0.5	23	3
Sodium hydroxide, NaOH	1.3	53	7

Temp. = 70° F (22° C)
Current Density = 19 amp/sq. ft. (2 amp/dm²)

O—Cyanide Bath—With Mercury—

The solution formula was the same as in N, with addition of mercuric oxide equivalent to 1 per cent of the zinc content. (Zinc anodes were used, and the necessary additions of mercuric oxide were made to the baths.)
Temp. = 70° F (22° C)
Current Density = 19 amp/sq. ft. (2 amp/dm²)

P—Acid Bath—High Sulphate—

Solution Formula

	N	g/l	oz/gal
Zinc sulphate, $ZnSO_4.7H_2O$	3	410	54
Sodium sulphate, Na_2SO_4	1	75	10
Aluminum chloride, $AlCl_3.6H_2O$	0.25	20	3

pH = 3 to 4 (Quinhydrone, or colorimetric corrected)
Temp. = 95° F (35° C)
Current Density = 47 amp/sq. ft. (5 amp/dm²)

Q—Acid Bath—Organic Addition Agent—

The solution formula was the same as in P, except that dextrin (7.5 g/l or 1 oz/gal) was substituted for the sodium sulphate. The conditions were the same as in P.

6. Conditions for Cadmium Plating:

Cast cadmium anodes were used. The operating conditions were as follows:

R—Standard—

Solution Formula

	N	g/l	oz/gal
Cadmium oxide, CdO	0.35	23	3
Sodium cyanide, NaCN	1.5	75	10
Sodium hydroxide, NaOH	0.4	15	2

Temp. = 70° F (22° C)
Current Density = 9 amp/sq. ft. (1 amp/dm²)

S—With "Gulac" as Addition Agent—

Solution Formula

	N	g/l	oz/gal
Cadmium oxide, CdO	0.7	45	6
Sodium cyanide, NaCN	2.5	120	16
Gulac	..	12	1.6

Temp. = 70° F (22° C)
Current Density = 19 amp/sq. ft. (2 amp/dm²)

T—With Gulac and Nickel as Addition Agents

The solution formula was the same as in S, with the addition of 1 g/l of nickel sulphate ($NiSO_4.7H_2O$)
Temp. = 70° F (22° C)
Current Density = 19 amp/sq. ft. (2 amp/dm²)

7. Conditions for Plating Zinc-Cadmium Alloys:

U—Anodes containing 90 per cent of zinc and 10 per cent of cadmium were used to produce deposits with approximately 10 per cent cadmium.

Solution Formula

	N	g/l	oz/gal
Zinc cyanide, $Zn(CN)_2$	1.2	75	10
Cadmium oxide, CdO	0.05	3	0.4
Sodium cyanide, NaCN	0.75	38	5
Sodium hydroxide, NaOH	2.25	90	12

Temp. = 95° F (35° C)
Current Density = 19 amp/sq. ft. (2 amp/dm²)

U-1—The cadmium content of the solution was reduced to produce deposits with about 5 per cent of cadmium.

U-2—The cadmium content of the solution was increased to produce deposits with about 15 per cent of cadmium.

Schedule of Deposits

All thicknesses in inches

4—Cadmium Finish

Expt.	Cleaning	Cadmium Plating Method	Cadmium Plating Thick	Variation
301	A	R	0.0005	Standard
302	B	R	.0005	Cathode pickle
303	C	R	.0005	Anode pickle
304	A	R	.0002	Thickness Cd
305	A	R	.001	Thickness Cd
307	A	S	.0002	Gulac brightener
308	A	S	.0005	Thickness Cd
309	A	S	.001	Thickness Cd.
310	A	T	.0002	Ni and gulac brightener
311	A	T	.0005	Thickness Cd
312	A	T	.001	Thickness Cd

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce. Part 1 was published in our June issue.

1—Nickel Finish

Expt.	Cleaning	Preliminary Plating Metal	Method	Thick	Nickel Plating Method	Thick	Variation
1	A	...	..	....	E	0.001*	Standard
2	B	...	..	....	E	.001*	Cathode pickle
3	C	...	..	....	E	.001*	Anode pickle
4	A	...	..	....	E-1	.001*	High temp., high pH
5	A	...	..	....	E	.0005*	Half thickness
6	A	...	..	....	E	.002*	Double thickness
7	A	...	..	....	F	.001*	Low pH
9	A	Cu	L	0.0005	E	.0005*	Cu(CN), Ni
10	A	Cu	L	.0005*	E	.0005*	Cu*(CN), Ni
11	A	Cu Cu	L M	.0001 .0004	E	.0005*	Cu(CN), Cu (acid), Ni
12	A	Cu Cu	L M	.0001 .0004*	E	.0005*	Cu(CN), Cu* (acid), Ni
13	A	Cu	M	.0003	E	.0002 .0005*	Ni,Cu (acid), Ni
14	A	Cu	L	.0003	E	.0002 .0005*	Ni,Cu (CN), Ni
15	A	Cu	M	.00015	E	.0001 .00025*	No. 13, half thickness
16	A	Cu	M	.0006		.0004 .001*	No. 13, double thickness
17	A	Cu	M	.0003	F-1	.0002 .0005*	No. 13, with Ni at low pH
18	A	Cu	M	.0003	E	.0002 .0005*	No. 13, heated 30 min. to 200°C
19	A	Cu	M	.0003	F-1	.0002 .0005*	Low pH and heated 30 min. to 200°C
21	A	Zn	N	.0005	G	.0005*	Zn, Ni
23	A	Cd	T	.0005	G	.0005*	Cd, Ni
24	A	Zn Cu	N L	.0002 .0003	E	.0005*	Zn, Cu, Ni
25	A	Cd Cu	T L	.0002 .0003	E	.0005*	Cd, Cu, Ni
51	A	...	..	....	E	.001	Standard, not*
52	A	...	..	....	E	.00025*	Standard, ¼ thick
53	A	Cu	M	.00008	E	.00005 .00013	No. 13, ¼ thick

2—Chromium Finish

Expt.	Cleaning	Preliminary Plating as in Expt. No.	Chromium Plating Method	Thick	Variation
101	A	1	I	0.00002	Ni-Standard
102	B	2	I	.00002	Ni-Cathode pickle
103	C	3	I	.00002	Ni-Anode pickle
104	A	4	I	.00002	Ni-High temp., high pH
105	A	5	I	.00002	Ni, 0.0005
106	A	6	I	.00002	Ni, 0.002
107	A	7	I	.00002	Ni, low pH
109	A	9	I	.00002	Cu(CN), Ni
110	A	10	I	.00002	Cu*(CN), Ni
111	A	11	I	.00002	Cu(CN), Cu,(acid), Ni
112	A	12	I	.00002	Cu(CN), Cu*(acid) Ni
113	A	13	I	.00002	Ni,Cu(acid), Ni
114	A	14	I	.00002	Ni, Cu(CN), Ni
115	A	15	I	.00002	Ni,Cu(acid),Ni(0.0005)
116	A	16	I	.00002	Ni,Cu,Ni (0.002)
117	A	17	I	.00002	Ni, Cu, Ni, low pH
118**	A	18	I	.00002	Ni, Cu, Ni, heated
119**	A	19	I	.00002	Ni,Cu,Ni,low pH, heated
121	A	21	I	.00002	Zn, Ni
123	A	23	I	.00002	Cd, Ni
124	A	24	I	.00002	Zn, Cu, Ni
125	A	25	I	.00002	Cd, Cu, Ni
126	A	13	I	.00001	Thickness of Cr
127	A	13	I	.00003	Thickness of Cr
128	A	13	I	.00005	Thickness of Cr
129	A	13	I-1	.00002	Cr at 35°C
130	A	13	I-2	.00002	Cr at 55°C
131	A	13	I-3	.00002	Cr at 65°C
132	A	13	J	.00002	CrO_3/SO_4 ratio=200
133	A	13	K	.00002	400 g/l CrO_3
134	A	None	I	.0002	Direct Cr thick
135	A	None	I-2	.0002	Cr at 55°C
136	A	None	I-3	.0002	Cr at 65°C
137	A	Cd*,S,0.0005	I-1	.00002*	Cd, Cr
138	A	Zn*,N, .0005	I-1	.00002*	Zn, Cr
152	A	52	I	.00002	Ni (0.00025)
153	A	53	I	.00002	Ni,Cu,Ni (0.0002*)
154	A	13	I	.0001	Thickness of Cr
155	A	13	K-1	.00002	400 g/l CrO_3, 55°C
156	A	13	K-2	.00002	400 g/l CrO_3, 65°C

* Buffed.
** Heated after chromium plating.

3—Zinc Finish

Expt.	Cleaning	Zinc Plating Method	Thick	oz./sq./ft.***	Variation
201	A-1	N	0.0005	0.59	Standard cyanide
202	B, A-1	N	.0005	.59	Cathode pickle
203	C	N	.0005	.59	Anode pickle
205	A-1	N	.0002	.24	Thickness
206	A-1	N	.001	1.18	Thickness
207	A-1	O	.0002	.24	Cyanide + mercury
208	A-1	O	.0005	.59	Cyanide + mercury
209	A-1	O	.001	1.18	Cyanide + mercury
210	A	P	.0005	.59	Acid, high sulphate
214	A	P	.0002	.24	Thickness
215	A	P	.001	1.18	Thickness
216	A-1	Q	.0002	.24	Acid, organic addition
217	A-1	Q	.0005	.59	Thickness
218	A-1	Q	.001	1.18	Thickness
219	Hot galvanized		.0009	1.05	Hot dipped

5—Zinc-Cadmium Alloy Finish

Expt.	Cleaning	Alloy Plating Method	Thick	Variation
401	A	U	0.0005	10 per cent Cd
402	A	U	.0002	Thickness
403	A	U	.001	Thickness
404	A	U-1	.0005	5 per cent Cd
405	A	U-2	.0005	15 per cent Cd

* Buffed.
*** Total weight for both sides.

Materials Used in This Investigation

Strip Steel:

Over 6,000 specimens, 4″ x 6″, were plated, including those to be used in laboratory tests. Cold rolled strip steel with selected good finish, 22 U. S. gage (0.031″); S.A.E. 1010 (approximately 0.1 per cent carbon), was donated by the American Steel & Wire Company.

Plating Equipment:

All generators, tanks, plating racks, etc., were furnished by the Bureau of Standards.

The anodes, chemicals and buffing materials were donoted by the following firms:

Grasselli Chemical Company.
Hanson-Van Winkle-Munning Company.
Harshaw Chemical Company.
International Nickel Company.
Roessler and Hasslacher Chemical Company.
Udylite Process Company.

Lead and Lead-Antimony Anodes for Chromium Plating

By E. M. BAKER and P. J. MERKUS

Respectively, Associate Professor of Chemical Engineering and Member of the Department of Chemical Engineering, University of Michigan, Ann Arbor, Mich.

The pure lead anodes were most resistant to corrosion in continuous plating; the alloys high in antimony were most resistant in intermittent plating. The equilibrium concentrations of trivalent chromium were about the same for all anodes, and were less than one gram per liter in 2.5 molar solutions of chromic acid (250 grams per liter)

A PAPER PRESENTED AT THE SIXTY-FIRST GENERAL MEETING OF THE ELECTROCHEMICAL SOCIETY HELD AT BALTIMORE, MD., APRIL 21, 22, AND 23, 1932.

THE anodes commonly used for chromium plating are steel, lead, and lead-antimony alloys. The behavior of steel anodes has been described by Baker and Pettibone.[1] It is the purpose of this paper, which is a continuation of the work done by Williams and Crimmins[2], to present some results of the study of lead and antimonial lead anodes in a chromic acid chromium plating bath.

Experimental Procedure

The plating was done in 600 cc. beakers immersed in a constant-temperature oil bath, which was maintained at 45° C. (113° F.) plus or minus 1° C. by a thermostat. The arrangement of the anode and cathodes in each beaker is shown in Fig. 1.

The anodes were 2.54 cm. (1 in.) wide, 3.1 mm. (0.122 in.) thick and were immersed 5.08 cm. (2 in.) in the solution. One such anode was placed in the center of each beaker. On each side of the anode was a steel cathode of substantially the same dimensions as the anode. However, a heavy coat of "Stop-off" lacquer[3] was previously applied to all the surfaces of the cathode except the side facing and parallel to the anode. Seven baths were connected electrically in series so that the same current would flow through each. The anodes in the seven baths contained respectively about 0, 2, 4, 6, 8, 10 and 12 per cent of antimony. The actual analyses of these anodes are given in Table 1.

The same current density was used for all experiments. The actual current was 2.7 amp., making both the anode and cathode current density approximately 10.5 amp./sq. dm. (97 amp./sq. ft.). The plating solution used for all experiments consisted of chromic acid, 250 g./L. (2.5 molar or 33.4 oz./gal.) and sulfuric acid, 2.45 g./L. (0.05 normal or 0.326 oz./gal.). The quantity of sulfuric acid includes the total of that originally present in the chromic acid and that added as sulfuric acid. The solutions were analyzed from time to time during the course of experiments. Additions were made as to keep the concentration of chromic acid and sulfuric acid constant.

Three series of experiments were carried out:

1. Continuous plating for the duration of the run.
2. Intermittent plating, *i. e.* plating for two minutes and turning off the current for one minute, repeating this cycle for the duration of the run.
3. Intermittent plating, in which plating was done for a fixed number of hours continuously and then the current turned off for a fixed number of hours, repeating this cycle for the duration of the run.

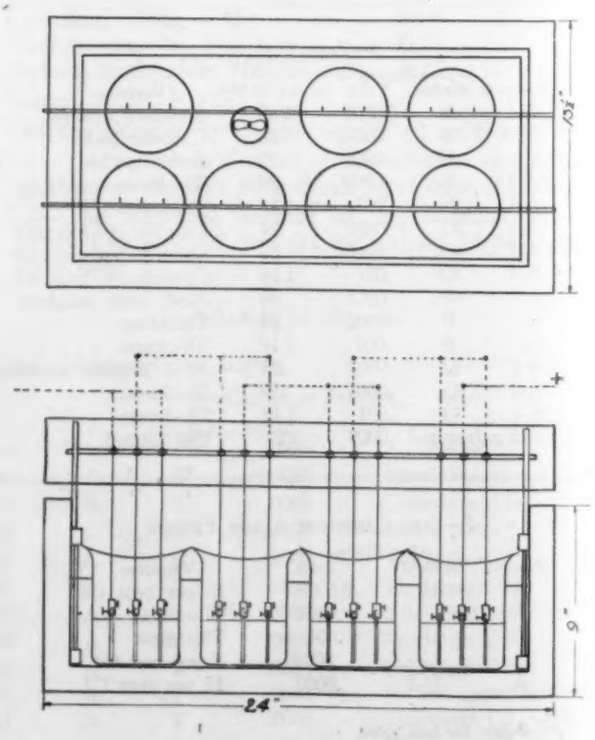


FIG. 1. DIAGRAM OF APPARATUS

[1] Steel Anodes for Chromium Plating, Trans. Am. Electrochem. Soc., 54, 331-336 (1928).

[2] Undergraduate Theses; Dept. of Chem. Eng., Univ. of Michigan (1928-29).

[3] A proprietary lacquer widely used as a temporary insulation of plating racks and for coating areas of electroles on which it is desired not to plate.

TABLE I. ANALYSIS OF ANODES

Number of alloy	Percentage of antimony
0	0.1
2	2.2
4	4.3
6	6.1
8	8.4
10	10.3
12	12.5

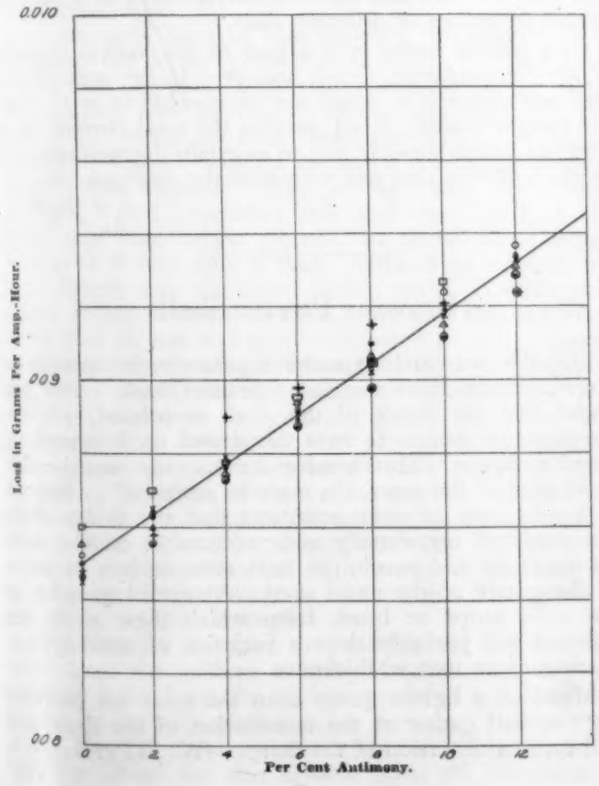
After the end of each run the anodes were taken out of the baths, washed, brushed off with a hand brush and dried. After drying, the brown coating was partly taken off by a revolving fine wire brush and the remainder of the coating removed with very fine sandpaper, taking care to remove as little of the metal as possible. The anodes were then weighed and the loss determined by difference. The brown-black coating was analyzed and found to contain both lead and antimony.

Results

The rates at which the anodes corroded were expressed as loss in weight in grams per ampere-hour.[4]

The data obtained for continuous plating show an increase in corrosion with an increase in percentage of antimony. The data of several experiments of this type are plotted in Fig. 2 and may be represented by a straight line within the limits of experimental errors. The slope of this line shows the corrosion to be about 0.000075 grams per ampere-hour per per cent of antimony.

[4] We expressed the corrosion as loss in weight in grams per ampere hour. This loss, of course, refers to a particular current density, but is independent of the size of the anodes. If the anodes, for example, were made twice as large and the same current density maintained, the loss in weight would be twice as great, but the number of ampere hours would also be twice as great, with the result that the same figure would be obtained when the rate of corrosion is expressed as grams per ampere hour. We recognize that it is desirable to express the rate of corrosion in terms of corrosion per unit of area when the corrosion is chemical in nature. When corrosion is a function of current density and time, however, there is a disadvantage rather than an advantage in expressing the corrosion in terms of unit area. While the rate of corrosion of the anodes is undoubtedly faster during the early stages and slower on continued use, we do not have any figures which will give comparative values. In this study also we made no experiments of any great value on the effect of current density on the behavior of the anodes.



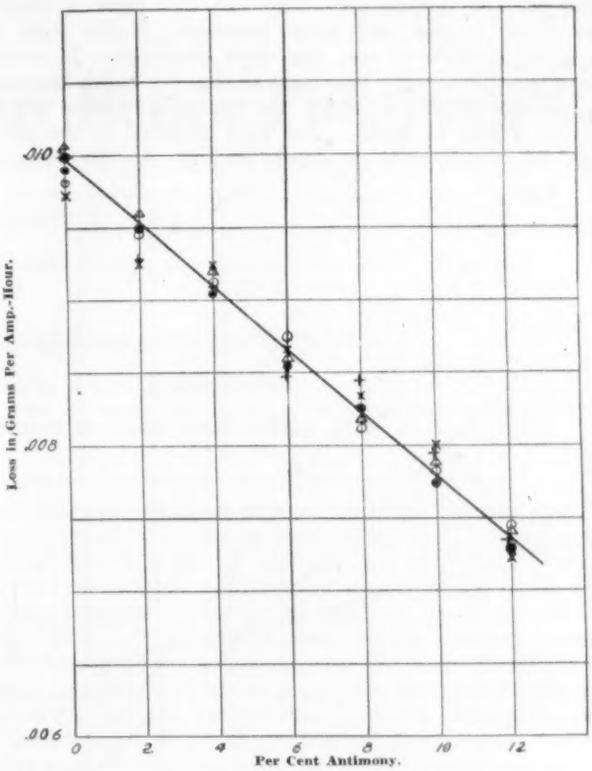


FIG. 3. DATA OBTAINED FOR INTERMITTENT PLATING

Bath 2.5 molar CrO_3, 0.05 normal H_2SO_4. C. d. = 10.5 amp./sq. dm.; temp. 45° C. Plating intermittent, 2 minutes on, 1 minute off, for approximately 56 hours.

× Run 301 100 ampere hours. ○ Run 306 100 ampere hours.
△ Run 302 100 ampere hours. + Run 307 100 ampere hours.
Run 303 100 ampere hours.

In the intermittent plating experiments, in which the current was on for two minutes and then off for one minute in a succession of three minute cycles, it was found that the corrosion loss decreases with an increase in percentage of antimony. These data may also be represented by a straight line, the slope of which is about —0.00022 grams per ampere-hour per per cent of antimony. These data are plotted in Fig. 3.

As far as the third series of experiments goes, in which plating is done continually for a fixed number of hours and the current turned off for another fixed number of hours, no general conclusion can be drawn. In the case in which the ratio of the total plating time to the total time of standing without plating is two to one, it may be said that the slope of the curve of loss per ampere-hour per per cent of antimony, is equal to the slope of the curves of intermittent plating of "two min-

FIG. 2 (AT LEFT). DATA OBTAINED FOR CONTINUOUS PLATING

Bath 2.5 molar CrO_3, 0.05 normal H_2SO_4. C. d. = 10.5 amp./sq. dm.; temp. 45° C. Plating continuous for approximately 37 hours.

× Run 101 100 ampere hours. + Run 105 100 ampere hours.
△ Run 102 125 ampere hours. □ Run 107 100 ampere hours.
Run 103 100 ampere hours. ○ Run 108 100 ampere hours
◑ Run 104 100 ampere hours.

utes on, one minute off" ratio. If this ratio is larger, say three to one, the slope increases; if the ratio is smaller, say one to one, the slope decreases. It would seem possible to vary this ratio so that the curve becomes a horizontal line in which the corrosion losses of all anodes would be equal. The data obtained in the third type of experiments is shown in Fig. 4. In general,

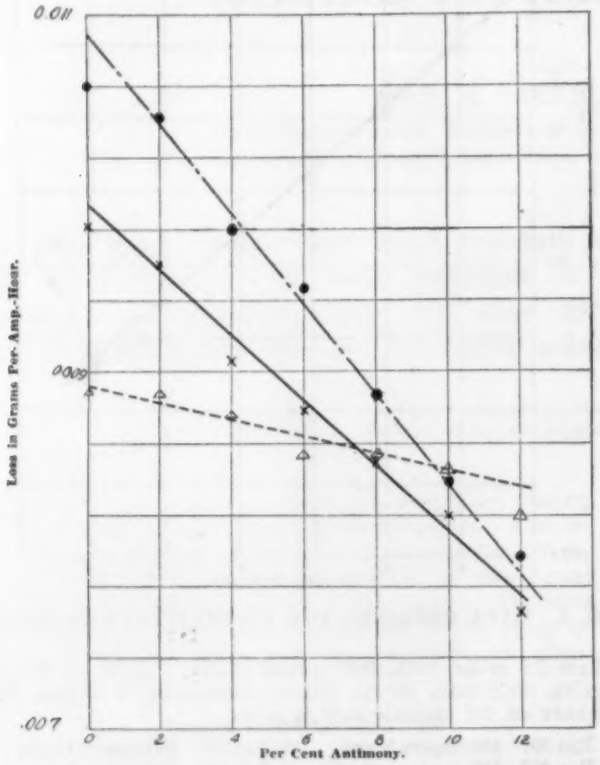


FIG. 4. DATA OBTAINED FOR "CONTINUOUS AND STOP" PLATING

Bath 2.5 molar CrO_3 0.05 normal H_2SO_4. C. d. = 10.5 amp./sq. dm.; temp. 45° C. Duration of test, 100 hours. Plating Cycle:

× Run 201
Cycle: Current on 16 hours. Current off 8 hours.

△ Run 202
Cycle: Current on 18 hours. Current off 6 hours.

● Run 203
Cycle: Current on 12 hours. Current off 12 hours.

however, where the conditions of operation are such that the bath is in more nearly continuous operation, pure anodes will show the least comparative corrosion and an increase in the idle time will progressively increase the corrosion of pure lead and alloys low in antimony and decrease the corrosion of anodes high in antimony.

Effect of Antimony in Anodes on Trivalent Chromium Concentration

The equilibrium or residual concentration of trivalent chromium does not seem to be affected by the percentage of antimony in the anodes. After plating continually for 450 ampere hours, the concentration of trivalent chrominum was considerably less than one gram per liter in a solution 2.5 molar in chromic acid. Differences in the determined concentrations of trivalent chromium from baths operated with the seven different anodes were less than the probable experimental error.

Conclusion

Antimony in the anodes increases the rate of corrosion in continuous plating, while it decreases the solution rate in plating when an intermittent cycle is used. In the chromium plating industry an alloy of 6 per cent antimony and 94 per cent lead is generally favored. If the two average curves of continuous plating and intermittent plating (2 to 1) were plotted on the same graph, they would intersect at about 5.2 per cent antimony.

The antimony content in lead anodes from 0 to 12 per cent does not seem to have any effect on the ratio of hexavalent to trivalent chromium in the plating solution.

We are indebted to the National Lead Company for supplying the lead antimony alloys, and to the General Spring Bumper Company for the chromic acid.

Barrel Nickel Solution

Q.—We are endeavoring to make up a nickel plating solution for the barrel process which will deposit a plate that will stand up under the following test:

Immersion for five minutes in the following solution without causing any blue coloration of the solution:

100 gms. Trichloroacetic acid.
700 cc. Water.
400 cc. Concentrated ammonium hydroxide.
Mixed in the above order.

A.—Any standard nickel solution that has from 3 to 3½ ozs. metal, 4-6 ozs. nickel chloride and 4 ozs. of boric acid can be used for this work. It is not so much the solution as it is the amount of current used and the time of plating. It is difficult to compute the surface area of a lot of screws and therefore, difficult to state that a certain weight should be run at a definite current density for a given time. The weight of screws and their surface area do not always agree. It will be advisable to run tests for time and the total current used in a definite weight of screws of different sizes.

In a plating barrel only a part of the load is directly in the electroplating circuit and even if the area of the load were known it would not be possible to state what the current density is. Therefore the total current on a weighed load is the only way to ascertain the time required to get a deposit that will withstand the required test.

G. B. H.

Drawing Pewter Shells

Q.—We are sending under separate cover sample of a shell drawn from a circular pewter blank. You will notice that the flange of this shell is pointed, whereas the customer desires to have this drawn up in a uniform circular flange. This trouble occurs only occasionally, as in most of the cases, the material comes up as desired.

A.—In view of your statement that the faulty shells are produced occasionally and presumably on the same set up of die and punch, the fault must lie in a variation of the gauge of the metal used. A careful gauging of the coils, strips or blank from which these shells are stamped will probably show a variation of several thousandths of an inch in thickness.

Metal of a lighter gauge than the tools are properly set for, will gather at the termination of the draw and will cause a distortion of the flange.—W. J. Pettis.

Better Electroplates by Better Polishing

By E. LAMOUREUX
Los Angeles, Cal.

Electroplating Development in Recent Years Has Neglected Polishing, Which Has Fallen into Decline, and the Electroplate Has Suffered.

SUPPLEMENTING my article in the April issue of METAL INDUSTRY, which covered several phases of the lost art of polishing in the industry of plating, it is my purpose at this time to cover other elements bearing upon this problem, from the angle of the history of the decline of quality plating in certain industries. It is my object to impress the trade with the all-important factor of really good plating and plated products that will endure.

The Bicycle Industry

A great many people, I am sure, will remember the rise and fall of this particular line, and the activity it created in polishing, plating and buffing; also the fact that at one time this vehicle of transportation occupied pretty much the same position with the general public as the automobile today, only perhaps in a smaller degree. During those days I was identified with several plants, supervising plating departments and, therefore, I am in a position to relate my experiences from first-hand knowledge.

In the early days of that industry the quality of the polishing had to be of the highest order. In fact it was considered the most important operation in the work. The plating was secondary. Please remember too, that the plated parts of these machines had to withstand exactly the same elements to which plating on automobiles is now exposed. And yet we rarely had rusting troubles. And remember too, that very little of that work was ever copper plated. In plants where copper was used it was only a flash, followed by rinsing, and then directly into the nickel plating tank. Another point which should be borne in mind is the fact that the equipment then in use was crude compared to the equipment now in practically all plating plants. And yet we turned out better work from the standpoint of durability. Another point to bear in mind is the fact that really high grade polishing has never been known, in the automotive industry in particular, but in other metal industries as well. Therefore, if we had no grief to contend with and our work endured to the satisfaction of the trade, is it not only reasonable to conclude that the difference must be attributed to the high grade of polishing insisted upon at that time, as against the poor grade of polishing prevalent today?

However, the standard of polishing did not last. We went from the sublime to the ridiculous. In fact that industry went from the highest grade of polishing ever known to actually plating upon surfaces of work from a dry No. 120 emery wheel operation. I have always laid the blame for this debacle upon the shoulders of the plating supply houses of that time, because they apparently hit upon the idea of selling more plating equipment and supplies at the sacrifice of polishing items. Just how it was expected to profit through this foolhardy procedure is still an unsolved problem. At any rate they introduced sulphate copper plating over a **dry emery wheel** polishing, and the term "Duplex Copper" was born. The campaign apparently had been well planned, because it wrecked polishing throughout that industry and threw thousands of polishers out of employment.

Fairly good results were produced experimentally by striking with cyanide copper plating or nickel, and then plating with the so-called duplex copper solution for several hours, and then buffing the deposit across the cut of the marks of the polishing wheel to cover up or fill in and then nickel plating over the buffed copper, followed by further buffing of the nickel deposit. When the plant owners saw the samples and the possibilities of savings in the polishing cost, they literally fell over each other putting in the process without any consideration of whether or not it would work as well on a production basis. Neither did they realize that they were taking away from the cost of polishing and applying it upon added plating and buffing, due to the extra amount of plating made necessary, and the buffing as well. Hence the whole procedure was false economy. When the process was installed it not only failed to work on a practical basis, but it was also found that no saving in actual cost had been effected. Besides, the work failed to endure under the elements to which it was exposed, again proving that the basis of a really good plate from the standpoint of durability is the proper preparation of the surface of the base metal by high grade polishing.

Stoves and Ranges

The manufacturers of these products have gone through an experience similar to those making bicycles, except of course that they never were interested in duplex copper plating. That fiasco does not apply to them. However, everybody knows that there is comparatively little plated work adorning stoves and ranges these days, and many will recall that at one time they were draped even to a greater extent with plated trimmings than the automobile of today. Why has plating been replaced with enameling on these products? It is because of false economy. In their endeavor to cut down cost in the wrong place and in the wrong way, namely, the polishing, and in the proportion that polishing operations were reduced, as well as the quality of the polishing was reduced, the durability of the product was

reduced, when they reached the point of two and three wheel work, the plating failed to endure. Not only that, but the beauty of the finished product was eliminated, and the sales appeal was also eliminated.

Bicycles, Stoves and Ranges, and the Automobile

If we take these three industries as examples, has it ever occurred to anyone that any cost of production reduced by means of eliminating polishing, or any other feature of the plated parts, really affected the cheapest part of the product as a whole? No one would argue the point that the plated parts, finished, ready for mounting are by far cheaper than any other parts of the product as a whole. The total cost of plating the parts of a bicycle, even in the days of the highest grade work, never exceeded $2.00. The same is true of stoves and ranges, and I doubt seriously whether the total cost of all the plated parts of the highest price automobile exceeds $10.00. If we consider these facts in the light of the selling prices, I am sure, the term "false economy" I have used is not out of place. Besides, my reasoning should be weighed from the angle of the risk of poor work incurred, which has actually resulted. Therefore, it would seem only reasonable that immediate consideration should be given to increasing such small cost by adding polishing of the right kind to be assured of plating that will endure.

It would seem to me that the plating supply concerns serving the trade are overlooking an opportunity for increased business in their failure to appreciate the wonderful field which is before them for improvement of plated products in all these three industries. With proper advertising and selling work the amount of plated trimmings on stoves and ranges, ought to be increased, because their product ornamented with beautifully nickel plated trimmings would have a much greater sales appeal. Any stove or range certainly is more beautiful, adorned with plated trimmings than any all enameled product. Furthermore, I am sure that really good polishing, and plating, even if we include chromium, can be produced on stoves and ranges at less cost than enameling, because there is a terrific loss in enamel chipping. All parts received by the jobber in that condition must be replaced by the manufacturer free of charge.

There is also plenty of room for improvement in polishing and plating of bicycles and motor cycles. It is a well known fact the makers of automobiles are searching for means to improve the durability of the plated work on their cars, and I am sure that the underlying phases of such improvements in all three of these industries is really good polishing.

Of the three industries mentioned, the one on which plated parts still prevail to a great extent is, of course, the automobile. My advice to them is to begin at once with investigation and research in their polishing rooms and stop the wasteful methods of poor polishing covered with heavy deposits which are mostly cut away in the buffing rooms, trying to produce a finish; besides buffs and buffing compositions wasted in defeating the purpose of good plating, by making it necessary to try and produce a high class finish on a poor job of polishing.

Preparation of Steel Prior to Electroplating

In his article in the February issue of METAL INDUSTRY my friend George B. Hogaboom covers a lot of valuable information. But the article leaves out entirely any reference to polishing as a vital part of such preparation. He does state that polishing does not remove particles of scale in the fine pits or in the pores of the steel, and that it is necessary to resort to pickling to remove these defects. However polishing of the proper kind would remove the scale from the fine pits in any steel, and, in fact would remove the pits themselves. When polishing fails in this respect, the operation cannot be termed really good polishing. If Mr. Hogaboom is correct in his theory, it is only further proof and support of my contention that good polishing is a lost art in our industry, today. A great deal, if not all, of the grief and tribulations of the plater brought about by the failure of plated coatings to endure, can be traced directly to that source.

Under acid pickling after cleaning Mr. Hogaboom advises that such pickling of sufficient strength to "etch" the surface of polished steel is necessary to secure a good bond of the electroplated deposit. I am not going dispute the statement, since I am sure he had in mind present day conditions with which the plater must deal. But I do wish to point out that we never found such a procedure necessary in the days of really good polishing. As an example it will be interesting, I am sure, to cite the fact that in those days work delivered to plating rooms was processed through cleaners and then we wiped the work with a soft brush or sponge with very fine pumice or rotten stone, so as not to scratch or mar the polished surface of the work. The acid used was an ordinary dip and the immersion was practically instantaneous. We certainly secured a good bond, because lifting or peeling of the plate was practically unknown. Besides I have seen handle bars and other steel parts bent and hammered and twisted in all sorts of shapes; and yet the plate never separated from the base metal.

As a further illustration, when electric cleaners were first introduced they were immediately discarded. Their use affected the very finely polished surface of the steel; so much so in fact that buffing of the plated work was made more difficult causing complaints from the buffers. Obviously no such situation could exist today, because of the poor grade of polishing, and the consequent extra buffing made necessary anyway. The inference may be derived here that if we were to return to really good polishing on steel and iron in all manufacturing plants, and had to "ruin" a perfectly good job of polishing, by acid pickling or etching of the surface to secure a good bond of the plate, it certainly would be a sad commentary upon our research people and experts.

Another phase of the article by Mr. Hogaboom relates to the amorphous coat or "skin" caused by polishing which must be removed by the etching pickle. I don't think that it is out of place to state here that this theory is rather far-fetched, particularly when it is advanced without any reference to variations in polishing. Besides the experiences related above, in connection with electric cleaners, and if the theory is correct, it should apply as well to brass and copper which is delivered to plating rooms with a highly buffed finish. We know perfectly well that no plater would think of resorting to etching such a surface to secure a good bond of the plate. The amorphous coat or "skin" in question cannot be created by polishing steel, any more than buffing or color buffing of brass and copper would create a similar "skin"; hence the etching of such surfaces made necessary to secure a good bond of the plate. If the "skin" is really present, my opinion is that it is not created by polishing, but rather it is left on the surface of the steel by the lack of polishing. I am also of the opinion that any acid pickle, as such, has no place in any plating room where plating is carried out on steel and iron. Where pickling is necessary, that treatment should be used before polishing. I don't mean to infer by this that acids should not be used in plating rooms, but there is a vast difference between an acid dip and an acid pickle.

Brass and Copper Versus Steel and Iron

I wish to refer here to another phase of these metals, regarding which very little if anything has been written. There are many plants where all four of these metals are processed every day, and every one knows perfectly well that the brass and copper parts are always delivered to the plating room with a beautiful highly buffed finish, whereas the steel and iron parts are delivered to the same plating room with a dull grey finish, or, with no more color or luster than if it was merely dry fined. Therefore, in the case of the brass and copper the finish is on the articles before they are plated, whereas in the case of the steel and iron parts the finish must be produced after plating. Now, all these parts are plated pretty much the same way, and while the brass and copper parts need only a coloring operation, the steel and iron parts must withstand a severe buffing operation to bring out a finish. Since they are both susceptible to rusting, is it not only reasonable that they should be highly polished before plating, so that the subsequent buffing would be only a coloring operation to let all of the metal deposited on the articles remain as a protection against the elements to which they may be exposed?

It seems that all investigation and research for a better plate, or standard of plate, as you will, of the last ten years has not helped enough to that end. Is it not about time that attention should be given to that other and very important phase of really good plating, namely, the polishing? May I be pardoned if I say, is it not seemingly absurd to continually rant and talk of a better plate, in view of the plating facilities now available? When anodes of the metals are 99 per cent plus; with standards of chemicals of equally high grade, and the most efficient generators ever produced, if plated products have not endured to the satisfaction of the user, it seems only fair to assume that the trouble has not been in the plating, but we must look elsewhere for the cause. Insofar as steel and iron are concerned, proper investigation of the polishing will undoubtedly bring vastly improved results.

A Note for Galvanizers (Hot Zincing)

THE ease with which zinc alloys with iron in the ordinary hot dip galvanizing process makes the securing of a continuous and adherent coating of zinc comparatively simple. If the surface of the iron or steel article has been properly prepared by pickling and coated with a suitable flux, the molten zinc will readily "wet" it.

One problem in galvanizing is to reduce to a minimum the quantity of dross which is generated in the process. This dross is an iron-zinc alloy which is formed as a result of the reaction between iron and zinc when they are brought together at galvanizing temperatures. There is a considerable variation in quantities of dross formed in different galvanizing plants and this is due to several factors. One of these, which is subject of a recent investigation, described in "Stahl und Eisen," is the introduction of iron in the galvanizing bath through iron salts formed in pickling.

All iron, scale and rust that is pickled off the work and dissolved in the pickling solution forms iron salts. If these are not removed, they will be carried into the galvanizing bath. Though iron salts such as iron chloride are volatile, it can nevertheless be expected that they react with zinc at galvanizing temperatures and as a result of such a reaction dross is formed. To find out if such a reaction takes place the following experiment was carried out:

A good grade of zinc which had an iron content of .016 per cent was melted in a fire clay crucible and the temperature maintained between 450 and 480 degrees C. (840 to 895 degrees F.). This temperature range corresponds to what is maintained in good galvanizing practise. A mixture of sal ammoniac and iron chloride was carried into the molten zinc bath in small portions. After two hours the bath was in a pasty condition and a chemical analysis showed that the zinc contained 1.70 per cent iron.

This experiment demonstrates that although no metallic iron was introduced into the bath, iron nevertheless was carried into it through the iron salt. What actually happens is, that zinc reacts with the iron salt resulting in the formation of a zinc salt and free metallic iron, which immediately alloys with the rest of the zinc.

Since the dross formed in galvanizing is nothing but an iron-zinc alloy, it follows that in order to keep the quantity of dross to a minimum it is necessary to remove the iron salts formed in pickling by means of thorough washing.—JAMES BRINN.

Welding Extruded Bronze

BY IRA T. HOOK

This paper was presented during the annual meeting of the American Welding Society, April 27-29th, 1932, in New York. The author describes briefly the extrusion process and gives general information about the metallurgy of extrudable bronzes and their constituents. He discusses also their welding properties, welding methods and practices, welding from the back and from the front and welding rigid frames. Special attention is devoted to Everdur metal, a proprietary alloy of the American Brass Company, which contains a base of copper and small percentages of manganese and silicon.

Light Metal Alloys

Coincident with the expiration in March of the patent on Duralumin, the light aluminum-magnesium alloy of the Duerener Metallwerke, other manufacturers in Germany have begun to produce it. The Bonner Leichtmetall-Werke is marketing it under the trade name Bondur. This alloy received special publicity from its use for equipment in the Graf Zeppelin. Other German light alloys of aluminum include Lautal, Silumin, Skleron and Pantal, the last recently brought out by the Vereinigte Aluminiumwerke. With patent expiration, the price of Duralumin has dropped 20 per cent. (Trade Commissioner W. T. Daugherty, Berlin, in Foreign Trade Notes, Bureau of Foreign and Domestic Commerce, Washington, D. C.)

Society for Testing Materials Meeting

High Spots of the Thirty-Fifth Annual Meeting of the American Society for Testing Materials

NO general statement could better sum up the Thirty-fifth Annual Meeting of the A. S. T. M. in Atlantic City over the period June 20-24, than that of Doctor Zay Jeffries, who in a session of the meeting said, "In my opinion the meeting this year has been marked by the pronounced co-operation of the Society members and groups; the cordiality evident in all of our committee meetings and sessions has been striking and in our work much progress has been made. These very constructive factors more than offset any disappointment which may be felt due to a somewhat decreased registration."

While it is but natural that some committee activities would have to be curtailed, there was no evidence in the meeting that such is the case. More than 155 meetings of main and subcommittees were held. Fourteen active sessions were necessary to make room for the ninety papers and reports presented. In addition, two informal conferences were held at which papers giving the importance and application of statistical data were presented. The list of items involving the non-ferrous metals field was more extensive than usual and two sessions were needed to permit the presentation and discussion of the papers.

The final report of the extensive research project on the embrittlement of hot-galvanized structural steel brought out the important fact that brittleness in shapes where the thickness is above ¾ in. was due to punching the rivet or bolt holes. Drilled or reamed holes in heavy sections prevent this dangerous phenomenon. "Galvanized embrittlement" in this size or medium size stock was not found.

Doctor Taylor, head of the Princeton University Chemistry Department, in his presentation of the Seventh Edgar Marburg Lecture on "The Problem of Resistance to Deterioration" outlined the tremendous strides made in the determination of speed of chemical reactions which is a major problem in understanding the causes for deterioration of materials and stated his conviction that chemists must devote more time to a study of chemical changes which promote deterioration and must investigate and discover inhibitors.

The Dudley Metal, awarded annually to the author of the outstanding paper given at the preceding annual meeting of the A. S. T. M. was won by C. A. Menzel, Associate Engineer of the Portland Cement Association, for his paper, "Tests of Fire Resistance and Stability of Walls of Concrete Masonry Units" given in Chicago in 1931.

It was announced that the 1933 meeting would be held in Chicago in June and that the Second Exhibit of Testing Apparatus will be held in conjunction therewith.

Cloyd M. Chapman, Consulting Engineer, New York City, succeeded F. O. Clements, Technical Director, General Motors Research Laboratories, as president. William M. Bassett, Metallurgical Manager of the American Brass Company, Waterbury, Conn., was elected vice-president.

The registration at the meeting was 700.

Two Complete Sessions of A. S. T. M. Meeting Devoted to Non-Ferrous Metals

The number of items involving the non-ferrous field in the program of the meeting was unusually large and as a result two full sessions of the meeting were devoted to the presentation of papers and reports in this group.

All of the committees in this phase of A. S. T. M. work made excellent reports. Several new standards and revisions in others were announced and much research work, now in progress or to be inaugurated, was outlined.

Committee B-1 on Copper Wire in co-operation with a joint committee of the American Railway Association, the American Electric Railway Engineering Association proposed specifications for trolley wire both of copper and bronze. These are amendments of existing A. S. T. M. specifications.

The Committee on Corrosion of Non-Ferrous Metals and Alloys presented a very important and extentive report. There is an urgent need for detailed descriptions of recommended practices for the carrying out of laboratory corrosion tests. General experience has taught that it is very difficult to establish and control test conditions so that a parallelism exists with a particular type of service. Consequently the committee members have collaborated and suggested outlines of procedure for the following:

(a) Preparation of Specimens for Laboratory Accelerated Corrosion Tests.
(b) The Total-Immersion Test and Procedure.
(c) Alternate-Immersion Test.
(d) The Spray Test.
(e) The Salt Spray Test.
(f) Accelerated Electrolytic Test.
(g) Field Corrosion Tests.
(h) Materials for Tests.

The committee has included a critical discussion of each test as well as a description of it.

Since copper water tube has been developed commercially so that it is now extensively used, there is a demand for specifications covering it. Accordingly Committee B-5 on Copper and Copper Alloys prepared

"Tentative Specifications for Copper Water Tube" which were approved for publication by the Society.

The several subcommittees of Committee B-6 on Die-Cast Metals and Alloys reported much progress in their work. The committee is following developments in magnesium and brass die castings and will undertake work leading up to standards when there is sufficient commercial justification.

Three new standards were approved for publication in the light metals field. Committee B-7 on Light Metals and Alloys submitted these as follows:

W. H. BASSETT

Metallurgical Manager, American Brass Company, Waterbury, Conn. Elected Vice-President, American Society for Testing Materials.

Tentative Specifications for Aluminum Alloy Rods, Wire and Bars.

Tentative Specifications for Magnesium-Base Alloy Sheet.

Tentative Specifications for Magnesium-Base Alloy Wrought.

Shapes (Other than Sheet).

An extensive paper on "Mechanical Properties of White-Metal Bearing Alloys at Different Temperatures" by H. K. Herschman and J. L. Basil, United States Bureau of Standards, was given. Ten bearing alloys were studied for wear resistance and other mechanical properties.

The usual white-metal bearing alloys require tin and antimony and since the potential military demands for these materials are considerable, the Bureau of Standards, at the request of the War Department, sponsored studies aimed toward the development of suitable substitutes. Of the alloys studied, two were tin-base, seven were lead-base and one was a cadmium-zinc alloy. No one alloy excelled in all properties studied. The tin-base alloys showed higher resistance to wear, but showed lower resistance to pounding than the others. Service tests were made in U. S. Army Trucks.

A newly developed automatic autographic extensometer was described by R. L. Templin, Aluminum Company of America. This will enable complete data to be secured on the yield strength of materials of a great saving over the old manual methods.

Other papers given were:

"Effect of Cold Working on the Izod Notched Bar Impact Value of Monel Metal" by N. B. Pilling, International Nickel Company.

"Factors Affecting the Physical Properties of Cast Red Brass (85 Cu, 5 Zn, 5 Sn, 5 Pb)" by H. B. Gardner and C. M. Saeger, Jr., United States Bureau of Standards.

"Method of Preparation of Lead and Lead Alloy Cable Sheath for Microscopic Examination" by W. H. Basset, Jr., and C. J. Snyder, Anaconda Wire and Cable Company.

Further Studies of Metals at High Temperatures.

The Joint Research Committee of the A. S. M. E. and A. S. T. M. on Effect of Temperature on the Properties of Metals made further contributions to the literature on metals at high temperatures.

A paper on "Influence of Recrystallization Temperature and Grain Size on the Creep Characteristics of Non-Ferrous Alloys," by C. L. Clark and A. E. White of the University of Michigan, presented the results of long-time creep tests conducted on copper-zinc, copper-zinc-tin and nickel-copper series at temperatures above and below their recrystallization temperature. These studies indicate that creep characteristics are greatly influenced by the recrystallization temperatures and by the grain size.

A very interesting mathematical discussion of thermal effects in elastic and plastic deformation was contributed by M. F. Sayre of Union College.

Indium Becoming Commercial

New discoveries of indium* will bring this metal into commerce, Dr. William S. Murray of Utica, N. Y., recently reported to the American Chemical Society. Indium was one of those elements which was supposed to be widely distributed in several kinds of ores, but always in minute amounts. The metal, first known in 1863, and named indium because of the indigo-blue lines in its spectrum, has been removed from the ore electrolytically and by volatilization, according to Dr. Murray.

"By careful and systematic search of all known ores, a district was found which has very rich indium ore deposits," Dr. Murray says. The indium seems to be a replacement in the ore of this particular district. By concentration, the ore has been made to yield a very high percentage of its indium content. These deposits will furnish substantial amounts of this element.

"Already several uses have been found for indium. It would seem to have use in the automotive, electrical, jewelry, and dental fields. There are undoubtedly many other places in which this element may be used. It would be desirable to know what it will do in medicine, radio, thermometry, and many other lines of work. Indium is no longer in the gram class, but is surely an ounce of metal."

*See "A New Commercial Metal—Indium," by Ellis K. Baldwin, "Brass World," May, 1932, page 98.

Correction—New Electric Furnaces

"Industrie" Electroofen, Koln, Germany, advises that the abstract of the paper read by E. Fr. Russ at the Baltimore general meeting of the Electrochemical Society, and published on page 190 of our May, 1932 issue, contained an inaccuracy in the translation issued to us. The sentence "Electric annealing in the induction furnace has been commercially applied," etc., should have read: "Electric annealing in the conveyor annealing furnace," etc.

The Fundamentals of Brass Foundry Practice

By R. R. CLARKE
Foundry Superintendent

A Description of the Basic Laws Which Control the Melting and Casting of Metals and Their Application to Practical Foundry Work—Part 29, Conclusion*

Mixing Alloys

THE same general practice prevails in the different types of furnaces for melting and mixing alloys, though in detail, slight differences occur. The average copper base alloy as previously noted, works best either when cast on second melting or on the basis of make-up where sufficient secondary metals like gates, scrap, etc., are included to tame down the new. This ratio works well: 60 new, 40 old down to 40 new, 60 old. On a 50-50 basis results are usually very good. In combining new metals in an alloy, the usual procedure is to melt higher temperature metals first, then add the lower constituents, as in 85-5-5-5 where the copper is melted first, under charcoal, and the tin, lead and zinc in order, introduced. The alloy is then well stirred and brought to pouring temperature. In adding zinc, it is well to cover the metal surface with sand, charcoal or other covering, while the zinc is pushed quickly and securely beneath the surface; this to avoid undue volatilization of the zinc.

Metals of higher than copper melting point, such as nickel, manganese, etc., are often best introduced in the concentrate form. The concentrate is simply a pre-prepared alloy, rich in the higher melting metal, such as copper 70, nickel 30, and is used in the casting alloy instead of the pure nickel to exempt the casting alloy from the high nickel fusing temperature. Phosphor-copper, manganese copper, silicon-copper and others are examples of concentrates.

Many metals of higher melting degree dissolve in the liquid bath of lower melting metals at the lower temperature, like iron in aluminum, nickel in copper, etc. In making concentrates it is best in such cases to depend upon dissolution rather than extreme temperature to effect the combination. The process is slower but undoubtedly better and less destructive. Most concentrates like phosphor-copper, silicon-copper, silicon-aluminum, etc., are commercially available and it is usually better to buy them already prepared than try to make them.

Fluxes

There are many neutral fluxes used in melting alloys. These are metal surface protections and reagents, and do not, as do manganese, phosphor, silicon, etc., become a part of the metal or contribute any inherent modifications. Many of these fluxes are of commercial manufacture, each forwarding its claims. As in all other phases of supply, some are good, some not so good, and some indifferent. Personally, the author has found crushed charcoal to answer the great majority of cases and to be efficient, economical and dependable. Other agents used at times are common salt, glass, plaster of Paris, zinc chloride for aluminum and common sand. In high zinc alloys the author has found common salt of value in keeping down the zinc oxides that mar the cope casting surfaces so disastrously.

Melting and Pouring Temperatures

A very important distinction between crucible melting and open flame is the matter of attaining and holding temperatures in the pouring ladles. In the open flame, where pouring off ladles or crucibles are necessary, an item of outstanding importance is to have these pouring ladles well pre-heated and not allowed to get cold and sluggish during the pouring. Where 4 and 5 ladles are required to empty a furnace, it is best to have 4 or 5 ladles pre-heated rather than to return with one ladle or more for second filling. In the pit crucible, this matter of preserving temperature is automatically fixed. Open flame melting presupposes pre-heated pouring ladles or crucibles and is not so secure. This phase of open flame manipulation is most important.

Practically all non-ferrous metals and alloys have a narrow range between the maximums and minimums of their very best pouring temperatures. An alloy of 78 copper, 16 lead, 4 tin and 2 zinc, can be taken as an outstanding example. A temperature of 2,150° F. has been positively established as the very best at which to pour this alloy. Below 2,110°, drossy metal in the casting and copious lead sweating begin to threaten. Above 2,175° the gaseous condition of the metal is disclosed in its earlier manifestations. The range of safe temperature, therefore, is only about 65° or 75° F. Now, a 200-pound ladle of metal drawn at 2,200° from an open flame furnace will drop 100° in a very short time. If, to compensate for this loss, the metal be raised to 2,300° in the furnace, then you have a metal severely punished to start out with. The very best practice yet found is to mold as close to the furnace as possible; demand fast work in the pouring manipulation; use crucibles, pre-heated thoroughly hot; have enough crucibles pre-heated to avoid a return to the furnace of the same crucible for a second pouring from the same charge, and graduate the crucible charge so as not to pour over 10 molds from it. In this way we can obtain temperature control and results.

This matter of melting and pouring temperatures is among the most critical factors of good castings, and can

* All rights reserved. This series will be collected and published in book form. Parts 1 to 28 inclusive were published in our issue of July, August, September, October and November, 1926; January, February, March, April, May, August, September, November and December, 1927; March, May, August, September and December, 1928; March, April and October, 1929; May, August and October, 1930; July and September, 1931; February, 1932.

be scientifically and satisfactorily controlled only by pyrometric measurement. After long years of experience and a finely developed sense of visual judgment of metal temperature, the author has come to realize that it can never meet the exactions of the best and most uniform practice. The use of a reliable, quick-reading pyrometer is the only sure, scientific way of doing the thing.

With respect to the proper pouring temperatures of the different metals and alloys, we might say that each one is a law unto itself and will not come under any generalization. A metal for instance of safe range from 2,000° F. to 2,075° F. might do well at 2,000° F. for a heavy chunky casting, but would be utterly unfit for a casting of light thin section at this same minimum temperature. As a matter of fact, it is each foundry's individual job to determine and repeat the best pouring temperatures of its different metals and castings according to the natures of these metals and castings, rather than to attempt to follow any general specifications of temperatures that might be taken to approximate them.

Electric Furnaces

The electric furnace is the coming method, already established and improving with research and experience. Among its earlier forms was the resistance furnace. This furnace generated its heat by resistance in a circular trough above the metal charge, the heat being deflected downward from the furnace roof and side walls. The principle was sound enough regarding metal quality, but rather slow of melting and cumbersome.

The present leaders are primarily of two types: indirect arc and induction. The induction furnace though it has great promise, has not yet attained the stage of all-around foundry practicability. Of the indirect arc type of furnace different forms are in use, some of more or less crude home make-up, others of more finished detail of manufacture. At this writing the two-electrode, self-adjusting, rocking type is probably the most highly developed and the best. This furnace is economical, fast and convenient, and if properly handled offers a secure method of producing the highest quality of metal and castings. At the present time, the writer is using these furnaces on a high tonnage basis for castings of the most exacting requirements, from a critical alloy, and is observing less than ½ of 1 per cent machine shop loss, an item never under 2 to 3 per cent in any other type of furnace and frequently running as high as 5 to 6 per cent. This ½ of 1 per cent loss is not a spasmodic or temporary accomplishment. It is a regular, daily realization dating back over a long period. In attaining this result the following practice is rigidly enforced:

Furnaces kept scrupulously clean and free of slag.

Furnaces lined and patched with strictly neutral linings and patchings.

Metal charges free of sand, oil, carbon forming insulation, etc.

Electrical equipment always kept in best condition.

All factors of practice such as inflow of current, maximum furnace temperatures, melting periods, charges, pouring temperatures, etc., are kept absolutely uniform and constant. Metal is taken from the furnace quickly in well pre-heated pouring crucibles and poured in the minimum time. To pour a 750 pound charge, 3 fresh, well-preheated crucibles of 250 pound capacity and handled by three different pouring gangs, are taken to the furnace, filled and at once despatched to the molds, only a short distance away, where by pyrometric determination, the metal is checked as to temperature, and poured.

No fluxes or coverings are used in the furnace, except for a trace of phosphorus added and a covering of charcoal placed over the metal after it is drawn into the crucible.

IF

With Apologies to Rudyard Kipling From a Metal Man

By A. L. MOLINEUX

IF you can keep your head when all about you
Are losing theirs and blaming it on you,
IF you can roll to minus half a thousand
And compound shear to plus or minus two,
IF you can work to Engineering Standards
To Rockwell, Pile or Izod impact test,
IF you can cast by the method known as Durville,
Strips just a little better than the rest—
IF you anneal and keep your crystal structure
The size and shape the text books tell you to
IF you can roll so flat that there's no reason
To stretch your sheets as other people do;
IF you can cast and not make spills and blisters
IF you can clean soft sheets without a scratch,
IF you can roll to satisfy the Air Board
And never get a reject in the batch—

IF you can buy when copper's on the up-grade,
IF you can sell before the drop sets in,
IF you can promise quicker than your rival
And keep your word and get the order in;
IF you can bear to see the strips you've cherished
Crushed in a case with many a bend and strain
And never say a word you hadn't ought to
But take them back and straighten them again—
IF you can go when toil and work are over
Not to your home and sit at ease and laze,
But rather hear some erudite professor
Discuss the Alpha-Beta-Gamma phase;
IF you can keep this counsel of perfection—
Smile to yourself, yet never brag or boast,
But just go on and do the job you're paid to—
You'll be a better Metal Man than most.

A Brass Foundryman's Progress

By OTTO GERLINE

Gerline Brass Foundry Company, Kalamazoo, Mich.

How a Boy Grew Up to Be a Brass Foundryman. His Adventures, Joys and Sorrows, as Told to W. J. Reardon—Part 8*

DEAR BILLY:

It will be impossible for me to give all the details of my several years on the road. It would take volumes to give all the experiences of this period of my life. I will, however, give you a few of the high lights and hope you will get a kick out of them.

I went to work for W. J. Garrett & Company and learned to make locomotive work, including locomotive bells. I also learned to make a few of the large bells up to one thousand pounds.

Few Side Lines

Here in St. Louis I also earned a few extra dollars by going on in some preliminary three-round boxing bouts which were then held regularly every night in Tom Allen's saloon. Tom was then the ex-heavyweight champion. We also got the same kind of work at Dan Dailey's saloon. Dan was Middleweight Champion of Missouri.

I also played semi-pro ball Saturday afternoons and Sundays. I got to be a fairly good pitcher and the late Charles Comiskey of the Chicago White Sox, who was then captain and playing first base for Chris Von Der Ahe's St. Louis Browns gave me a trial, but I failed to make good. I could not behave myself, and a successful pitcher cannot stay out nights drinking Anheuser-Busch Beer and get anywhere. This also goes for boxing. So I quit all that stuff and stuck to the brass foundry game.

By this time I got the Wanderlust again and went on the road, going as far as New Orleans. In due time I got homesick for old Erie, Pennsylvania. The boys all told me when I left that I would come home sorry and broke. I wanted to show them different. I saved up enough money to buy a new suit of clothes and what goes with it. I put them all in a trunk and expressed them to Girard, Penna. I then beat my way up to Girard, had my clothes pressed, dressed up and came into Erie in style on a first class passenger train. My balance was twenty-nine dollars in one dollar bills. It made quite a roll, and with my new suit and all, I made quite an impression on the boys, and also on some of the girls.

I could not connect in Erie, so I left my trunk, new suit, etc., and hit the road for the East, working at the New York Locomotive Works in Rome, New York, for George Krause in Jersey City, the Nathan Manufacturing Company in New York, for some firm in Hartford, Conn., and also in a small shop in Boston. I then started south, stopping off to work in Cramp's Shipyard in Philadelphia; also the Baldwin Locomotive Works.

After leaving the Baldwin Locomotive Works, I took another swing South and West, landing in San Francisco, where I worked for a short time. From here I went through Arizona, New Mexico and Texas, and into Old Mexico. After about a year in Mexico I again took a trip North and East, making Jersey City my home. On all these trips I learned a little more about the game. I also learned that to one without parents, relatives, friends and last but not least money, this can be a cruel world.

Life on the Road

I will now wind up my hobo experiences as far as working is concerned and give you a few of the outstanding high lights on traveling in the days before hitch-hiking was in force, when the brakebeams, bumpers, box cars, cattle cars, and blind baggage cars were the means of getting you over the country. I can truthfully say I tried them all. I rode Pullman cars, under, above, and in later years, inside.

I once got into a car loaded with wheat. I got in through the little end door on which some hobo before me broke the seal (a prison offense, if you are caught). It got cold during the night and I covered myself with the grain and went to sleep. In the morning when I awoke I was almost buried alive. I could not get out of the grain. I was in almost to my armpits. The only thing I could do was to yell until someone heard me. I was using my lungs to my heart's content, when at last someone stuck his head in through the door and asked what the racket was all about. I soon told this fellow and he said he would get help. He got two other men supplied with shovels and they partly shovelled and partly pulled me out of my bed. I had my shoes, socks, and every pocket full of wheat but I was happy to be out, believe me.

I thanked the men for getting me out and started to walk away, when this man said, "Just a minute, Buddy," and pulled back his coat, displaying the badge of a Railroad Detective. "You come along with me and tell the judge why you broke a seal on a loaded railroad car." (Not so good). I knew I didn't break that seal, but to make this fellow and the Justice of Peace believe it was another thing. It was just as hard to explain as it was for Amos to explain to the police officers that he did not kill Jack Dixon. However, I finally talked and cried myself out of the mess, and after a good fatherly talking to, they let me go.

Another time I left Council Bluffs, Ia., in an empty stock car. It was on the 21st day of February and about twelve below zero. I was all okay until the train got out into the open prairie and then the wind began to "blow through my whiskers" as the saying goes. I ran back and forth in this car, making more mileage than the locomotive that was pulling it, trying to keep from freezing to death. My feet got so cold (I had no rubbers) I took off

*Parts 1 to 7 were published in our issues of July, 1929; November, 1929; May, 1930; August, 1930; February, 1931; September and December, 1931.

my shoes and wrapped my feet in my coat and when I got too cold over my shoulders I put on my coat again but found that my feet had swollen so that I could not get my shoes on. I now ran back and forth in my stocking feet. I was near all in when the train stopped for water. A brakeman went by and I called to him, hardly able to talk. He got another brakeman and they carried me back to the caboose, undressed me and rubbed me with snow until I thought I would burn up. They took me into Hannibal, Missouri, where I spent about a week in the hospital.

Another time I got into a lumber car where I had just room to stand in the center and in under the small end door. The car was a box car and loaded to the roof, leaving only enough room for a man to stand up. This was okay until the train stopped and started, when the sudden stopping and starting closed up this space and barely allowed me to get out and ride the bumpers the balance of the way.

Once in Texas I was in a car that had been used for hauling watermelons and a lot of straw was left in it. It was fairly warm in the afternoon, but during the night, what they call in Texas, a "Norther" came up and the thermometer dropped rapidly. I got so cold I decided to light a little of the straw and build a little fire for myself in the car. I started it all right, but couldn't stop it. The straw was dry and burned like powder and all I could do was to climb out of the end door and run over the top of the cars. The smoke was then pouring out of the car in a cloud. I heard the engineer give one short blast of the whistle (the stop signal) and the train commenced to slow down. I got down the side ladder of another car and did 100 yards in nothing flat. They never did catch me, but I was some scared young man, believe it or not.

Another time at Gila Bend, Arizona, the sheriff gave me 24 hours to get out of town. About fourteen miles out of Gila Bend there is, or was, a water tank for the locomotives to take on water. There is also a sharp curve and a stiff grade. The trains would cough and puff to make it. This gave the trainmen plenty of time to look for " 'bo's" and believe me they did look for them, and what's more, they found them. I have forgotten how many times they threw or kicked me off. Some of the trains would stop to take water and others would go by the tank too fast for me to get on. As they got near the tank, they had gone over the grade and were gaining speed. I walked from this tank to the town and vice-versa a good many times. I finally got into a refrigerator car with its ice-box door open enough for me to get into. I got in all right, but soon I began to freeze on one side, and I would turn over and freeze the other side, while the first thawed out. With the wet sawdust on the ice, I soon became a nice looking mess. However, I would get away from Gila Bend and that meddling sheriff. Just when I was feeling tickled to get away, a lantern was held down in the icebox and an unwelcome voice said, "Hello, 'bo, where do you think you are going?" "I am trying to go to Tucson," I answered. "You are the same kid I kicked off here several times, aren't you?" "Yes, sir," I replied. "You got any money?" "If I had any money, I certainly would not be riding in this ice-box." I replied. "Well, you better come out here and pile off when we slow down on the next grade." I got off, and he got off and stood beside me until the caboose came along. He got on the front end and I got on the rear end, climbed up on the roof and lay down behind the cupola of the caboose. I listened to him telling the other brakemen about finding me again and further remarked, "Well, he will have a nice 26 mile walk back to town," and he laughed. "A good hyena laugh" I thought, but I laughed last when I climbed down the ladder when we entered the freight yards in Tucson, and used my thumb (not the way the hitch hikers use it).

I was unfortunate enough to be at Casa Grande during the American Railway Union (sometimes called the Debs) strike. Everybody was scared of everyone else. Union men, scabs, as they called them, and railroad detectives by the score were all around and the chances for getting a ride were nil. You know some of the trains at that time pulled one or two water cars behind the engines (as water is scarce in some parts of Arizona) and I climbed into one of these empty cars. They are about eight or nine feet in diameter, and I never gave that a thought when I dropped through the manhole on top into about a foot of water. I was surprised when I felt the water, but anything was better than staying in Casa Grande and so everything was lovely until the train started with a jerk and the water went over me with a rush. The same thing happened when they stopped too suddenly. I looked like a drowned rat when the train came to a stop. I now noticed that I could not get out of the tank. The fireman was pulling down the water spout and getting ready to fill the tank with water. Believe me, Billy, I made plenty of noise kicking the sides of the tank, and hollering. He finally discovered me and called the brakeman. "Look what we have here, Jack," was his remark. "Well, I'll be damned," was the answer from the brakeman. Together they got hold of my hair and lifted me up far enough to get a better hold and then they threw me off the car. I landed in a prickly pear bush and for a while after I picked cactus needles out of myself as far as I could reach them. Some were in parts of my anatomy that I could not reach and the pain was so severe that I went to a little hospital they had near here, to have them picked out. I had a very sore body for some time as some of the needles broke off and began to fester. Altogether it was a nice experience.

There is only one thing about these trips that I cannot understand and that is this. I know it is not right to steal a ride on a railroad, but what bothers me is why is it that if you have twenty-five or fifty cents, a good pocket knife or a pair of cuff buttons to give the brakeman, he can carry you, and if you haven't these things, he will lose his job if he carries you (so he says).

I haven't a thing to say about the regular tramp who will not work, but a fellow that is sometimes forced by circumstances to take the road, could be treated perhaps a little more humanly than I have been treated by a good many of the men who now come into my office and ask for advertising donations for their journals, also picnics, etc. I have never given a nickel to any of these fellows' organizations, and I hope I never will. "For a quarter I'll carry you. If you haven't a quarter pile off or I will throw you off," is too firmly impressed on my mind.

To the young fellows learning the trade, I would say, it will not do you any harm to travel and work at different kinds of work and in different shops, but travel by automobile, train, or airplane if you like and can afford it. Don't "hobo" it except as a last resort. Personally, I always believed it is more honorable to hit the road when you are up against it than to run a board bill on some poor woman whom you can never pay and then beat her out of it.

I could tell you about a good many more interesting trips, but it would take too long, Billy, and I am anxious to tell you about my career, beginning with my marriage to the best old Pal in the world.

This series will be continued in an early issue.—Ed.

Weathering of Soldered and Tinned Sheet Copper

ACCELERATED weathering tests of tin and solder covered copper may be made in humid atmospheres containing 1 per cent SO_2, 5 per cent CO_2, and 94 per cent air by volume, if maintained around 50° C. or over. In the March number of the Bureau of Standards Journal of Research results are given in tabular form showing that tin and electro-tinned copper are but slightly attacked by the above atmosphere.

On the other hand, heat-treated electro-tinned copper and hand-tinned copper are badly corroded and very badly pitted, while soldered copper, if heated to high temperatures previous to weathering, is markedly furrowed, resulting in a decrease not only of the strength of the sheet at the joint but also of the number of bends required to produce failure. The pitting is due to the formation of a brittle copper-tin layer which, upon cracking, exposes copper and forms with it the cathode of a galvanic cell. The furrowing of copper at the solder-copper junction is also due to similar galvanic action.

Microscopic study revealed that the copper alloyed with the molten tin of the tin coating or of the solder to form definite layers. The layers of tin-copper alloys adjacent to the sheet became richer in copper the higher the temperature used during tinning or soldering. The pitting of copper caused by galvanic action set up between these copper-rich alloys was considerable. At lower temperatures, less alloying occurred, with the result that the tin coat contained very little copper and the pitting and furrowing were markedly diminished.

Poor technique in the use of flux is not the cause of seam corrosion, but can cause pitting of copper. The prevention of seam corrosion and pitting of copper coated with tin-bearing materials lies in the prevention of the formation of copper-tin alloys. The corrosion can be reduced to a minimum by using low temperatures during tinning and soldering.

Copper Castings

Q.--Kindly advise what is the best way to melt and pour copper castings for electrical work.

We use Coke fired crucible furnaces bedded down with anthracite coal, forced draft. The copper used is Lake copper, covered with fine charcoal, fluxed with a very small amount of phosphor copper. We even used dry sand molds for small castings, but the sprues would boil up after the castings were poured and the castings would be full of gas holes. The holes are bright.

A.—In casting copper for electric work, phosphorus is not the best deoxidizer. The addition of 1/10 of 1 per cent phosphor will reduce conductivity considerably.

We suggest using 3 ozs. of 10 per cent silicon copper to the 100 pounds of copper melted. In melting, place all the copper in the crucible if possible. Do not place copper on the coal around the pot. Place fine charcoal in the bottom of the crucible. Melt with as much speed as possible with a good fire.

Keep the metal covered and get it good and hot, 2,200 F. Add the silicon copper a few minutes before pulling out the pot. Stir and pull out for pouring.

Make a test before pouring the metal by ramming up a blank mold and insert a 2½ inch sprue pipe down about 3 inches. Pour the copper in. If the metal comes up, add more silicon copper—say 1 oz. per 100 lbs. and soon stir and pour another test.

If the melting is done properly the metal will shrink down in the test sprue. If not, it will rise up. There is no use pouring your casting until a satisfactory test shows in your test mold.

You can add up to 8 ozs. of silicon copper to 100 pounds of copper. When adding over that you will run into dirty castings and lower the conductivity. Your molding should be so arranged as to take up all shrinkage by placing riser large enough to give a solid casting.

W. J. R.

Copper Rods

Q.—Can you give us a list of the typical rolling equipment used in mills which roll copper rod? We suppose this rod is either made up into screw machine products or probably mostly into wire. We are most interested in the type of equipment used for making copper rod from ¼" to ⅜" in diameter.

Is extrusion used much for this type of work?

A.—The raw material produced by copper refineries for making copper rods and wire is the "wire bar." This generally ranges in weight from 135 lbs. up to 770 lbs. The bar is tapered. The 250-lb. bar is largely used in making the sizes specified in your inquiry. This measures 53" long, 4-5/16" at top, 4" at bottom, and 3-3/16" deep.

The equipment, broadly, consists of a three-high grooved roughing mill and a train of finishing rolls, with a capacity as high as fifty thousand pounds of ¼" rod per hour.

The auxiliary equipment calls for furnaces with all necessary tools, washing and cleaning equipment, and many other items.

One manufacturer of such equipment has put on the market a smaller mill, with a capacity of ten thousand pounds per hour, to meet the needs of those requiring a smaller output, while still maintaining a cost per pound in line with the large competing units.

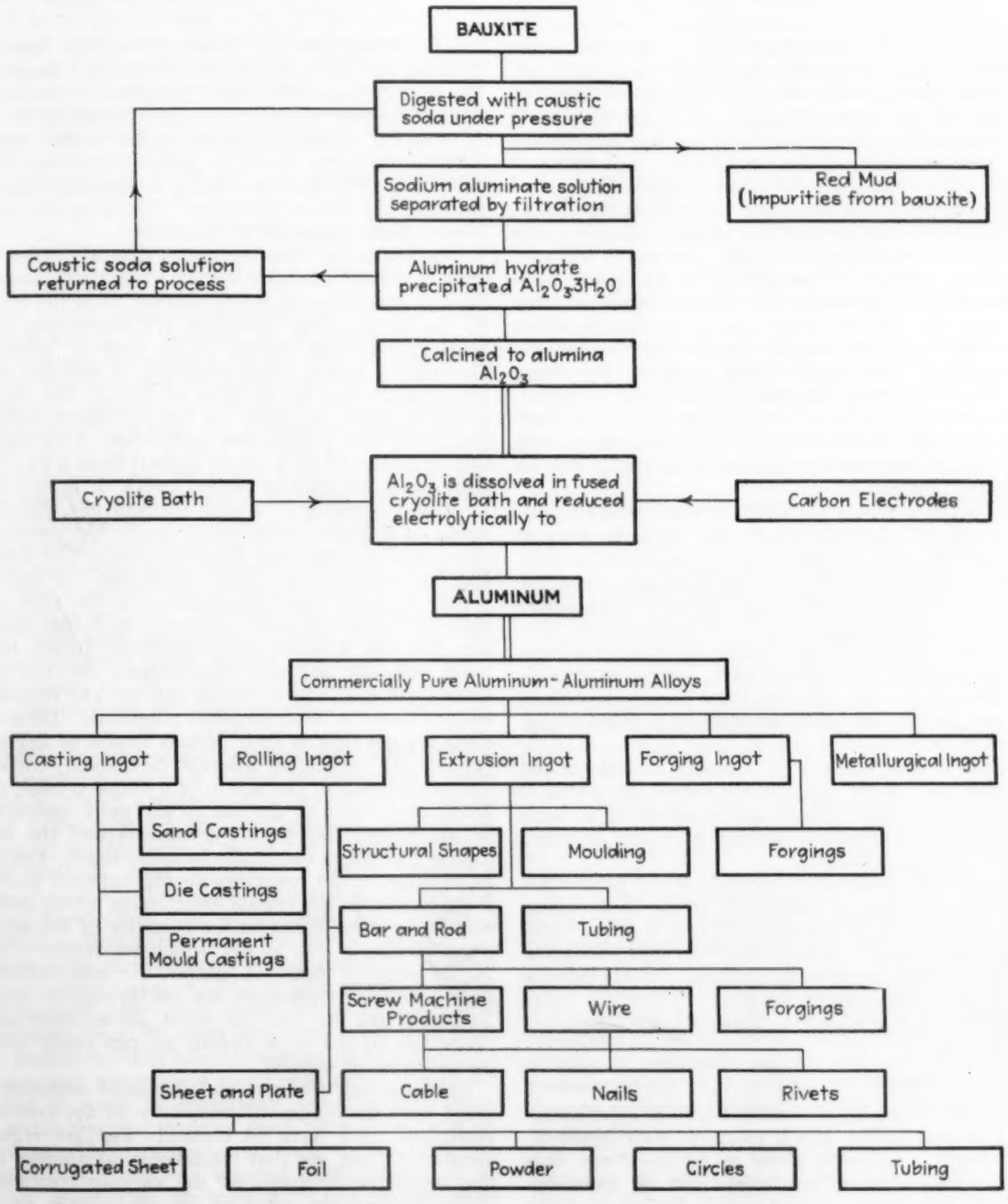
The foregoing is but a bare sketch of the process, but it covers all the fundamentals. A great mass of detailed information could be written that would be of value to the prospective purchaser of this equipment in selecting one of the several types that would best meet his needs. The writer will be glad to furnish such information as is within the scope of his personal knowledge and experience.

No extrusion for this type of work is being practiced.

W. J. PETTIS.

Aluminum Production and Its Applications

THE past ten years has seen a huge increase in both the production of aluminum and the number of its uses. Output in the United States (by far the world's largest single producer) climbed from 24,500 metric tons in 1921 to 103,890 metric tons in 1930. Production in Canada and other countries similarly expanded. The chart which is reproduced here by courtesy of "Metal and Mineral Markets," New York, shows the number of primary forms in which aluminum is today available, as well as the various forms through which the metal passes before reaching the primary metallic forms mentioned in the lower half of the chart.



Editorial Contents and particulars on advertising page 4 (before text); Buyers' Guide on advertising page 41 (after text pages).

EDITORIALS

The Nature of Metals

A PAPER, by E. E. Schumacher of the Bell Telephone Laboratories, published in the January Scientific Monthly describes the nature of metals in relation to their properties, giving a discussion of the hardening and strengthening of metals. It is one of the best expositions that we have yet seen, of the constitution of metals and alloys, their properties, and the relation of the findings of research to the practical problems involved in the manufacture of metals and alloys. An abstract of this paper should be of interest to every worker in metals.

The modern science of metallurgy is concerned, to a large extent, with explaining why metals behave as they do, and why the methods employed in production affect metals as they do. By the aid of the microscope, the spectroscope and the X-ray, rapid progress has been made in recent years in the analysis of metal structure, and a considerable body of information has been built up. A large part of that information is concerned with the relationship between the nature of a metal and its hardness and strength.

Metals, most of which are solid at room temperature, are composed of irregularly shaped crystals pressed closely together. The crystal itself is made up of tiny "building blocks" or atoms, arranged in a geometrical pattern which is called the "space lattice." This lattice differs in shape and dimensions with different metals. The position of the atoms in the lattice determines certain planes which extend throughout each individual crystal. Sliding takes place easily between these planes since there are no atoms to interfere with the relative motions of the two sections.

The hardness and strength of a single crystal depend upon its resistance to the force which causes the planes to slide over one another. "Plastic deformation" in a single crystal results from sections sliding over one another, each section moving as a unit.

Hardness is the ability of a metal to resist plastic deformation, the deformation being the result of a sliding of crystal sections on its planes. Therefore, any alteration in the metal which will interfere with such sliding or "slip," will cause an increase in hardness. Such increase can be brought about in three ways.

1. Alloying of two metals to form a solid solution.
2. Cold work.
3. Heat treatment.

The alloying of two metals to form a solid solution results in a crystal lattice which contains both kinds of atoms. In such a mixture there is probably not only general tightening of the atomic bonds, but also some distortion of the slip planes, caused by displacement of the atoms from their regular positions. Either of these changes may be great enough to increase the "resistance to slip"—in a word, "hardness."

Cold work, such as bending, rolling, hammering or drawing the metal when cold, results in a breaking up of the large crystals into small fragments. There is considerable elongation of the individual crystals in the direction of working. Also, the planes of the atoms change their direction and the lattice is severely strained. This indicates that cold work hardening is caused by at least two factors: (1) lattice distortion; (2) disregistry of the slip planes, from fragment to fragment.

Hardening by heat treatment depends upon the presence in the alloy of two or more homogeneous parts, the relative quantities of which depend upon the temperature of the metal. Heat treatment and subsequent operations must increase the amount of the part or "phase" which stiffens the lattice. This stiffening is probably caused by the precipitation of particles of one of the phases, said particles acting as "keys" in the slip planes and preventing them from sliding over each other. This phenomenon can be produced by a single quench from a high temperature (as in the case of carbon steel), or by a double heat treatment; heating to a high temperature, quenching and aging at a lower temperature, as in Duralumin, Tempalloy, lead-calcium and lead-antimony. The last process has been named the "Age Hardening" of metals. The purely practical, hard-headed man in the shop may consider all of this exposition interesting if true, but he may also feel that it is not very important. In this he is mistaken, because adequate explanations for the action of metals will enable us to devise new ways of treating metals to give us even better physical properties. These explanations are not easy to find. Metals consist of aggregates of crystals, all turned in different directions. Consequently, the explanation of the action of a single crystal, described previously, must be applied to the more complex system of aggregates before the treatment and the action of metals and alloys can really be understood. For example, in addition to the resistance to slip between planes, there is resistance at the crystal boundaries, which unquestionably has a great effect on the behavior of the metal. Another reason is that atoms, which we formerly regarded as the simplest form of matter, are now known to be highly complex structures, not yet thoroughly understood. Scientists tell us that we must know more about the properties of the atom before we can really understand the behavior of metals.

In the search for new and improved materials we are faced with the numerical immensity of the field to be investigated. We have 64 elements that are regarded as metals. We can see that the theoretical number of alloys that might be produced by the varying combinations is almost incalculable, when we consider that in an ordinary card deck of 52 cards, the possible combinations into hands of 13 cards totals 635,013,559,600. So we have here a field for exploration which is practically unlimited

in size. We know what seems to be a great deal about metals, but the unknown and uncharted territory is infinitely larger than that which has been explored.

As pointed out by F. O. Clements in a recent paper for the American Society for Testing Materials*, a few of our more obvious needs are such products as stainless aluminum and stainless magnesium alloys; improvements in our knowledge of plating on aluminum alloys and magnesium alloys. We need not set up such a dream specification as was once jokingly prepared in the Chevrolet organization, for a metal with the lightness of magnesium, the wearing qualities of cast iron and the electrical conductivity of copper. But we do still have plenty of room for metals and alloys which have a higher ratio of strength to weight; a metal with a higher modulus of elasticity than steel; more accurate knowledge of metals under stress at high temperatures; the alloying of tantalum with iron for corrosion resistance; a method of softening tungsten so that it may be machined and then re-hardened; and so on, almost ad infinitum.

Such ideas may sound like dreams at this time, but the next ten or twenty years will see many of these problems solved.

The Brass Foundry Needs New Spark Plugs

AT the recent annual convention of the American Foundrymen's Association, E. H. Ballard, the incoming president, delivered a strong address urging its members to look forward and to take the long pull view of the foundry industry. Foundrymen must battle with other industries as well as competing foundrymen. Stamping, rolling, die casting, permanent mold casting and other methods have all taken their "cut" from the foundry industry. Consequently the sand foundry has, even in good times, not prospered as it should.

No truer words could have been said. The foundry industry has made strenuous efforts in the past ten years, realizing this situation. Brass foundries have improved their production methods. They have cut costs in material handling. They have standardized alloys. They have demanded and obtained better ingots. They are now turning out a product far superior to what it has ever been in the past. But they are still laboring under the "curse" of castings.

The brass foundry industry needs new spark plugs. It needs something to give it a fresh impetus from a business point of view; something that will create sales, as chromium plating raised the electroplating industry to undreamed of heights several years ago. Improvement in operating methods, lowering costs, a better product—these are all excellent, but without the spark, without that something which fires the imagination and brings a product to the direct attention of the buying public.

Just what is to give the brass foundry its lift? Nobody at this time seems to know. Will it be new alloys which will find markets where they never existed before? Will it be new products to fill needs long felt? Will it be such startling improvement in alloy properties as to make them better than other materials in many new uses? We do not know. But it must be something fundamental. Nonferrous metal castings made in sand have given way on many fronts. They must change their tactics from defense, like cost-cutting and internal improvement, to attack. They must press into new fields and replace other materials.

Such advice is easier to give, we realize, than to put into effect, but if it is to save itself from obscurity and perhaps complete obsolescence the brass foundry must wake up.

Stealing Business

WE have been informed by the Metropolitan Brass Founders Association, Inc., of New York, of a most extraordinary type of fraud which has been perpetrated upon its members. It seems that a number of brass foundries in the Metropolitan District received telephone calls from a man who represented himself to be an agent of a large rubber manufacturing company. In each instance the message indicated that this company was in urgent need of a quantity of aluminum castings, and that the patterns were being sent to the foundry being telephoned. Meanwhile, in order to save time, the man asked for the names of several customers of the foundry as references as to their ability to produce aluminum castings.

It later developed that the only object of these telephone calls was to secure the names of possible users of aluminum castings. Although most of the foundries smelled a rat, one was trusting enough to give some names and as a result lost one of its best customers, who accepted a ridiculously low quotation from the perpetrator of the fraud.

We have never heard of a cheaper or more disreputable method of building up a mailing list. We know that the Metropolitan Brass Founders' Association, Inc., is following up this matter and intends to prosecute it to the legal limit. We wish them every success.

Recommendations Without Prejudice

WE, like all other journals, receive occasional letters of complaint. We welcome criticism as a stepping stone to improvement. But there are complaints and complaints. Witness the following:

"We have traded with your house for some time and cannot find one instance where you have recommended any one to use our products. We are given to understand that your paper is controlled by the large manufacturers in our line, and that would be one good reason why we do not get any recommendations from you. If that is so, we want our advertising cancelled."

Let us take up these statements one at a time.

1. We never recommend—in print—any manufacturer of a product, unless that product is made by that one manufacturer alone, and nothing else will do.

2. When recommendations are asked of us and we answer by mail, we give, without prejudice, all of the reputable manufacturers in that line. As a matter of fact we have a number of times recommended the very company which sent in the above complaint.

3. METAL INDUSTRY is owned and controlled by its stockholders only. These stockholders do not include, directly or indirectly, any firm or individual in the metal manufacturing, electroplating or foundry industry or any firm or individual manufacturing or selling supplies to those industries.

4. The taking of advertising or the cancelling of advertising has never and will never effect the recommendations of METAL INDUSTRY to consumers who ask for information about materials, equipment or supplies which they may need.

We make the above statements not in anger, but simply to straighten out one who has been misinformed, and to advise others who may be under similar misapprehension.

*Limitations of Our Fundamental Knowledge of the Properties of Metals, presented in the joint meeting, on February 18, of the A. S. T. M. members in the New York Metropolitan District, and the Iron and Steel Division, Institute of Metals Division, and New York section of the American Institute of Mining and Metallurgical Engineers, with the cooperation of the New York section, American Welding Society.

Correspondence and Discussion

Metal Industry Invites Correspondence on Subjects of Interest to Its Readers.

Plating Name Plates

Editor, METAL INDUSTRY:

Under above heading, Problem No. 5058 in your January, 1932, issue drew my attention as I am engaged in plating this class of work, I was interested in trouble described, and with all due respect to the answer given, I will give you my view of their trouble.

I am using, with success, a silver solution of the same proportions given by the analysis. I use this solution to plate lead tinned barn and name plates. The name plates, to avoid peeling, must go directly into this silver solution. **Do not run through strike.** It is the strike that will cause the plates to peel when engraved. Of course, you must have an efficient cleaner.

Richmond, Indiana. W. WRIGHT.

Etching Pewter

Editor, METAL INDUSTRY:

I should have acknowledged your letter before, but I waited until I had been able to try out the advice you so kindly gave me.* I found that while hydrochloric acid, as suggested, worked well with some brands of pewter, in others (possibly where there was a certain amount of lead in the alloy) the electrolyte was much improved by the addition of a small percentage of perchloric acid. I just mention this fact as it may be of interest to your expert.

I am very greatful to you for your help in this problem.

WILLIAM H. TAIT.

Sunbury-on-Thames, England.

* Mr. Tait was advised on pewter etching. We suggested a 10% solution of hydrochloric acid in water, with 2 to 4 volts reverse current, and lead cathodes. Acceleration might be effected by increasing the acid strength up to 25%.—Ed.

Government Publications

United States Government publications are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom proper remittance should be made to cover price where a charge is mentioned. In some cases, as indicated, applications should be made to the governmental body responsible for the publication.

Lead in 1931—Advance Summary. Bureau of Mines, Washington, D. C. Circular.

Bibliography on Standardization. Bureau of Standards. Miscellaneous Publication No. 136.

Copper Industry in 1931—Advance Summary. Bureau of Mines, Washington, D. C. Circular.

Mercury Industry in 1931. Bureau of Mines. Advance summary. Mineral Market Report, M. M. S. 103. Free from Bureau.

Magnesium Industry in 1931. Bureau of Mines. Advance Summary of Statistics. Circular M. M. S. 107. Free from Bureau.

Colors for Sanitary Ware. Bureau of Standards. Commercial Standard CS30-31, a recorded standard of the industry. 20 cents.

Spreading Work, by William J. Barrett, President's Organization on Unemployment Relief. Methods and Plans in Use. Free.

Cadmium Industry in 1931. Bureau of Mines, Washington, D. C. Circular M. M. S. 112. Summary of statistics. Free from Bureau.

Aluminum Trade and Industry of Germany. Commerce Reports, March 14, 1932. Department of Commerce. Apply to Department.

Wire Insect Screen Cloth. Bureau of Standards. Simplified Practice Recommendation R122-31. Sold by Superintendent of Documents.

Sheet Steel, Flat, Terne, Coated (Long Terne). Federal Specifications Board, Washington, D. C. Circular on proposed Federal Specification.

Dental Lathe Grinding Wheels. Bureau of Standards. Simplified Practice Recommendation R130-32. Sold by Superintendent of Documents.

Chromium, by Lewis A. Smith, Bureau of Mines. Information Circular 6566. 31 pages. Covers all phases of chromium properties, uses, markets, statistics.

Grinding Wheel Simplification. Division of Simplified Practice, Bureau of Standards. Proposed Revision of Recommendation R45-28. Complete data available from the Division mentioned.

Hose Connections for Welding and Cutting Torches. Bureau of Standards, Washington, D. C. Recommended commerical standard TS-1743. Organizations producing, distributing or consuming this commodity, as well as others interested, are asked to examine and approve.

Industrial Hygiene Leaflets. Division of Industrial Hygiene, New York State Department of Labor, 80 Centre Street, New York. Leaflets have been issued on prevention of: Lead Poisoning; Arsenical Poisoning; Silicosis Poisoning; Mercury Poisoning; Chrome Poisoning; Occupational Dermatitis. All free on request to the Department.

Federal Specifications. Sheets covering proposed federal specifications or revisions of specifications are issued by the Federal Specifications Board with a request for comment by interested parties. Sheets on the following subjects are now available from the Board: Sheet Lead; Silver Solder; Copper-Nickel-Alloy Castings; Manganese Bronze Bars, Plates, Rods, Shapes; Aluminum Alloy Ingot; Round Seamless Aluminum Tubing; Aluminum-Copper-Magnesium-Manganese Alloy Tubing, Round, Seamless; Seamless Copper Tubing; Aluminum Alloy Bars, Rods, Shapes and Wire.

Silver Consumption in Arts and Industries. Bureau of Mines, Washington, D. C. Economic Paper 14; Superintendent of Documents; price, 10 cents. Abstracts:—The position of the United States in many phases of the silver industry is outstanding. The products of the chemical industry contain more silver than those of any other, but most of them are semifinished. Sterling silverware requires more silver for its manufacture than any other product, but the silver content of the finished product is less than that of the silver salts in the chemical industry. Nevertheless, sterling silverware leads in the ultimate consumption of silver. The photographic industry is second only to the sterling-silverware industry in ultimate consumption of silver. Some manufacturers specialize in fabrication of semifinished precious metal products purchased by two groups of finished-products manufacturers: (1) makers of jewelry, optical goods, and novelties and (2) industrial companies. The manufacture of dental supplies requires one-half million fine ounces of silver a year, most of which is used for amalgam fillings. Silver nitrate is used in the silvering of mirrors.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

Metallurgical, Foundry, Rolling Mill, Mechanical

H. M. ST. JOHN — W. J. PETTIS
W. J. REARDON — P. W. BLAIR

Electroplating, Polishing, and Metal Finishing

O. J. SIZELOVE — A. K. GRAHAM, Ph.D.
G. B. HOGABOOM — WALTER FRAINE

Aluminum Flux

Q.—When melting down alumium scrap, what should we use to clean the aluminum before pouring same. There is a flux used and we would like to know what it is.

A.—To clean scrap aluminum a flux that gives excellent results is composed of 50% cryolite and 50% rock salt. This will reduce your melting loss and also clear the metal. This flux is used by a number of smelters of aluminum scrap.

W. J. R., Problem 5,106.

Barrel Copper Plating

Q.—We use a tank with a horizontal bakelite cylinder for copper plating, and our results are quite satisfactory We plate staples similar to samples enclosed. The bakelite cylinder is bulging in the middle and may not last much longer. There is quite a little work involved in plating our staples because they stick in the 3/32" perforations, and have to be pulled out at every unloading. For these two reasons we think there may be some advantage in changing our equipment. We have been experimenting with an oblique tumbling barrel in which the solution is pumped back and forth into the wooden barrel when in its highest position. An iron wire basket containing copper scrap of high quality (which we accumulate in making copper rivets and washers) is suspended in the solution. A negative contact rod is so located so as to make good contact with the staples as they pile up on one side as the barrel rotates.

With the copper cyanide solution at about 90 degrees, we can only get 135 amps through the solution. The results are not very satisfactory. The deposit is rather light and the color is not as good as the work from the other machine. Can you tell us why our results are no better? The oblique type of barrel is made by a number of manufacturers. It seems to work, but not good enough. It would seem that this process would be quicker, easier and less work.

A.—We are inclined to believe that you are placing too much work in the oblique cyanide copper barrel. A barrel of this type does not have the anode surface that the horizontal type of barrel has, therefore the cathode surface should not be as large. Try a smaller load of work, and if results are not satisfactory, send us a sample of the solution for analysis.

O. J. S., Problem 5,107.

Barrel Nickel Plating

Q.—We have a horizontal tank and cylinder for nickel plating. The solution was made with 18-oz. of prepared nickel salts per gallon of water. Solution is heated to 75 degrees and our generator is 6 volts, 300 amps capacity.

Our first call for plating involved nickeling cotter pins and washers, samples of which are enclosed. Sample of our solution

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all blanks if possible.

Date .....

Name and address: .....**Employed by:** .....

Kind of solution: .....**Volume used:** .....

Tank length: .....**width:** .....**Solution depth:** .....

Anode surface, sq. ft.: .....**Cathode surface, sq. ft.:** .....

Distance between anode and cathode: .....**Kind of anodes:** .....

Class of work being plated: .....**Original formula of solution:** .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary.

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

is also being mailed to you, and we would be interested to get the analysis and your comments.

We were unable to do any plating. The barrel was run four or five hours and all the current we got through the solution was 20 amps.

A.—Analysis of nickel solution:

Metallic nickel	0.27 oz.
Chlorides	0.78 oz.
pH	5.2

All the constituents are entirely too low. We would suggest that you discard the solution and make a new one. Use the original formula if you have the salts; if not, use the following formula:

Double nickel salts	8 oz.
Single nickel salts	8 oz.
Boric acid	3 oz.
Sodium chloride	3 oz.
Water	1 gallon

O. J. S., Problem 5,108.

Bronze Plating

Q.—I am sending sample of bronze solution for analysis. The plate comes streaked and hard, showing brass in the recesses, and cannot be kept an even color; also has very poor conductivity.

We are plating hinges, and I am sending a hinge so you can see where the difficulty lies. They are plated sixteen to the rack, horizontal to each other with two inch space between hinges.

A.—Analysis of bronze solution:

Metallic copper	3.37 oz.
Metallic zinc,	0.42 oz.
Free cyanide	1.59 oz.

Analysis shows that the free cyanide content is too low. This is the cause of the deposit being streaky with a brass color in the back ground.

We would suggest that you add 1 oz. sodium cyanide to each gallon of solution, and then operate the solution at 95° F. It may be necessary to add an additional ½ oz. sodium cyanide to each gallon of solution, but the free cyanide content should not be too high as this will cause blistering of the deposit.

O. J. S., Problem 5,109.

Silverware Plating

Q.—We are experiencing some trouble in silver plating on 18% nickel silver. We do not buff the handles or bowls of our products. We clean the metal very thoroughly by acids before stamping under drop hammers, and yet in processing spoons through the plating department we get quite a number of what we call peelers. In other words, the plate does not bridge, particularly on the inside of the bowls.

We are mailing you five teaspoons showing a little scum. These have been washed through our whale oil soap cleaner in preparation for plating. These spoons have been buffed or cut down on the bowls with tripoli, then washed in whale oil soap, after which it is put through a white chip soap bath, agitated, and then through three rinses. These spoons then go to the electric cleaner before plating.

Is there a cleaner solvent that will remove this without impairing the surface, or better still a preventive for the scum in the wash tanks?

A.—We are of the opinion that your trouble is due to improper cleaning methods. The samples that you sent were cleaned as you have outlined, and there still remained on the inside of the bowl a sufficient amount of the buffing composition to cause peeling.

If you do not wish to use mechanical means to remove this, we would suggest the use of a quick dip in a weak bright dip bath. This dip is made of sulfuric acid 2 parts, nitric acid 1 part, water 1 part. This dip will attack the surface of the work very little, and after silver plating and coloring is not noticeable. This operation should be used after the electric cleaning operation. Following the dip, the work is rinsed in water; cleaned in an alkaline cleaner such as you are using for the electric cleaner; rinsed in water; immersed in a cyanide dip; rinsed in water; and plated.

O. J. S., Problem 5,110.

Nickel for Instruments

Q.—We are sending two samples of solution which we will appreciate your giving us analysis on nickel, acid and chlorides.

We would also like your recommendations as to best nickel plating bath to use and the best operating procedure to follow in plating springs for manicure implements. You probably are aware that there has been a great deal of discussion about such springs being rendered brittle and unserviceable through nickel plating. Please advise the quickest way to conduct the work so that such brittleness can be minimized.

Perhaps you can tell use whether the composition of the steel has any bearing upon the amount of hydrogen which will be absorbed by the steel during the plating process?

A.—Analysis of nickel solution:

Metallic nickel	1.47 oz.
Chlorides	2.06 oz.
pH	5.2

The metal content is quite low, and the pH entirely to low. Add 4 oz. single nickel salts to each gallon of solution, and to each 100 gallons of solution, add 12 oz. 26° ammonia. After this correction has been made to the bath, it will be in good operating condition for your class of work.

To overcome the embrittlement of steel springs, we would suggest that they be heat treated after plating; this will eliminate the trouble. Place the work in an over for two to three hours at a temperature of 350° to 400° F.

O. J. S., Problem 5,111.

Solders and Fusible Alloys

Q.—I would like to know how to make an alloy with a fluid melting point of 300° F. and a softening point as close to 300° F. as possible. This alloy should readily "stick" to other metals, such as iron or steel, and should not oxidize under ordinary atmospheric conditions. The alloy should also be capable of being heated almost to its melting point, and cooled any number of times without losing any of its properties. It would also be desirable to have a slight expansion on solidifying, and little or no expansion or contraction when heated to its softening point.

A.—The following table shows the compositions of some solders and fusible alloys in common use that may answer your purpose:

Lead	Tin	Bismuth	Zinc	Antimony	Melting Point F.
40	60	0	0	0	334 F.
33.3	67.7	0	0	0	340
33.3	33.3	33.3	0	0	284
		Expanding Alloys			
67.7	0	0	8.3	25	150
77	6	0	0	17	320

A list was given in METAL INDUSTRY, March, 1909, that we would refer you to, and which may assist you in arriving at what you may require.

W. J. R., Problem 5,112.

Stripping Silverware

Q.—We have large quantities of old silverware, both brass and nickel silver, spoons, etc., that we would like to strip. We would appreciate your informing us of the best way to strip this material with the least injury to the base metal, as we would like to refinish them, and as this has to be done on a large scale, the strip should be both cheap and practical.

A.—We suggest that you use the following strip to remove the silver from the nickel silver and brass base metal that has been silver plated:

Sulfuric acid	5 parts
Nitric acid	1 part

Strip should be used hot. Usual method is to place strip in a stoneware crock which is placed in larger tank filled with water and heated with steam. All water must be kept out of the strip itself.

O. J. S., Problem 5.113.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,847,044. February 23, 1932. **Process for the Improvement of Nickel.** Arthur Burkhardt, Frankfort-on-the-Main, Germany, assignor to American Lurgi Corporation, New York, N. Y.

Process for the improvement of the mechanical qualities of nickel and nickel alloys containing sulfur which comprises adding thereto while in the molten state an agent comprising lithium which serves to bind the sulfur content thereof.

1,847,555. March 1, 1932. **Treatment of Aluminum.** Francis C. Frary, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.

The method of removing gas, dross, oxide films, and other detrimental inclusions from aluminum consisting in contacting the molten metal with titanium tetrachloride in gaseous form.

1,847,929. March 1, 1932. **Copper Alloys.** Otto Dahl, Berlin, Germany, assignor to General Electric Company, a Corporation of New York.

An alloy consisting substantially of copper, beryllium and chromium, the beryllium and chromium constituting together not appreciably more than 6% of said alloy, the beryllium constituting not appreciably more than 1% of said alloy.

1,848,391. March 8, 1932. **Tumbling Device for Electroplating.** Harrison D. Simpson, Newark, N. J., assignor, by mesne assignments, to Baker & Co., Inc., Newark, N. J.

In an electro-plating apparatus, an article container comprising a barrel made of non-conducting material, heads fixed in said barrel and having conical extensions, the walls and heads being split longitudinally to produce to equal sections and said walls being perforated.

1,848,797. March 8, 1932. **Treatment of Aluminum-Silicon Alloys.** Aladar Pacz, Cleveland, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa.

The process of modifying aluminum base alloys containing between about 3 and 35 per cent of silicon comprising covering the molten alloy with a salt flux and thereafter introducing through said flux and into said molten alloy an alkali metal.

1,848,798. March 8, 1932. **Process for Modifying Aluminum Alloys Containing Silicon.** Aladar Pacz, Cleveland, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa.

The process of modifying aluminum base alloys containing silicon, comprising adding to the molten alloy a compound having an acid reaction, and an alkali metal.

1,848,816. March 8, 1932. **Aluminum-Silicon Alloys.** Robert S. Archer, Lakewood, and Louis W. Kempf, Cleveland, Ohio, assignors to Aluminum Company of America, Pittsburgh, Pa.

A heat treatable alloy composed chiefly of aluminum and containing silicon between about 2.5 and 14 per cent, magnesium between about 0.1 and 0.5 per cent, and copper between about 0.1 and 1.5 per cent.

1,848,857-1,848,858. March 8, 1932. **Copper-Silicon-Zinc Alloys.** Louis P. Webert, Waterbury, Conn., assignor to The American Brass Company, Waterbury, Conn.

A copper base alloy containing about 1.0 per cent to about 4.5 percent silicon, about 1.0 percent to about 15 percent zinc, manganese within the limits of 0.1 percent to about 1.5 percent, and the balance copper.

1,849,293. March 15, 1932. **Process of Electrodepositing Indium.** Daniel Gray, Oneida, N. Y., assignor to Oneida Community, Limited, Oneida, N. Y.

The process of electro-depositing indium, which comprises preparing an aqueous solution containing indium chloride, adding ammonium hydroxide to this solution until a slight precipitate is formed, then adding a water-soluble organic acid which will hydrolyze slowly in the presence of an alkali, and passing a direct current through electrodes immersed in the bath, whereby the indium is deposited on the cathode.

1,849,767. March 15, 1932. **Process of Preparing Molding Sands for Easily Oxidizable Metals Such as Magnesium.** Gilbert Michel, Bagneux, France, assignor to Societe "Le Magnesium Industriel," Paris, France.

Process of preparing foundry sand for molds and cores in which easily oxidized metals such as magnesium are to be cast consisting in lining the parts of the mold in the vicinity of the cast metal with a mixture comprising graphite and an ammonia compound.

1,850,355. March 22, 1932. **Alloy.** Charles D. Russell, Sheboygan, Wis., assignor to Ruselite Corporation, Milwaukee, Wis., a Corporation of Wisconsin.

An alloy consisting of a major portion of aluminum, together with .05-5% molybdenum, .05-5% chromium, and 2-14% zinc.

1,850,416. March 22, 1932. **Art of Metallurgy.** Charles D. Russell, Sheboygan, Wis., assignor to Ruselite Corporation, Milwaukee, Wis.,

An alloy comprising a major portion of copper together with 3-12% aluminum, .10-5% molybdenum, and .10-3% of one of the corrosion resisting metallic elements tantalum and chromium, said alloy possessing high tensile strength, tenacity, and ductility.

1,850,419. March 22, 1932. **Alloy.** Henry F. Schroeder, Milwaukee, and Charles D. Russell, Sheboygan, Wis., assignors to Ruselite Corporation, Milwaukee, Wis.

An alloy comprising approximately 90% zinc, 5% copper, 3.50% aluminum, .50% chromium, .12% molybdenum, and .15% tantalum, said alloy possessing high tensile strength, tenacity, and ductility.

1,850,426. March 22, 1932. **Process for Electrodepositing Chromium and the Like.** Warren Ayres Tyrrell, Merrick, N. Y., assignor to Chemical Treatment Company, Inc., New York.

In a method of electrodepositing a metal such as chromium accompanied by the disengagement of large quantities of hydrogen, on the inside of hollow articles, removing hydrogen from the solution at localities intermediate the ends whereby the concentration of hydrogen in the plating solution at the end or ends is reduced.

1,850,517. March 22, 1932. **Aluminum Alloy.** Charles D. Russell, Sheboygan, Wis., assignor to Ruselite Corporation, Milwaukee, Wis.

An aluminum alloy comprising a major portion of aluminum together with 3-10% copper, 0.75-5% chromium, and 0.10-5% molybdenum, said alloy possessing high tensile strength, tenacity, and ductility.

1,850,612. March 22, 1932. **Magnesium Base Alloy.** Robert T. Wood, Lakewood, and Harold H. Block, Cleveland, Ohio, assignors to American Magnesium Corporation, Pittsburgh, Pa.

A magnesium base alloy containing 0.1% to 15.0% tin, 0.1% to 5.0% zinc, and 0.1% to 20.0% cadmium.

1,850,613. March 22, 1932. **Magnesium Base Alloy.** Robert T. Wood, Lakewood, Ohio, assignor to American Magnesium Corporation, Pittsburgh, Pa.

A magnesium base alloy containing 0.1% to 15.0% tin and 0.5% to 5.0% manganese.

1,850,818. March 22, 1932. **Alloy.** Romaine G. Waltenberg, Roselle, Henry Edwin Holbrook, Irvington, and Bert Brenner, Elizabeth, N. J., assignors to The H. A. Wilson Company, Newark, N. J.

An alloy containing between 50% and 90% ruthenium, and the remainder consisting of one or more of the metal platinum, iridium and rhodium.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Power Exhaust Units for Buffers and Grinders

The Standard Electrical Tool Company, Cincinnati, Ohio, announces a new motor driven exhaust unit which may be mounted on their heavy duty grinders and buffers.

The illustration shows their combination grinding and buffing machine equipped with 3 H.P. General Electric motor with General Electric automatic starter and push button station.

Grinder with New Type Power Exhauster.

Both the grinder and buffer sides of machine are fitted with enclosed hinged door guards, each having exhaust outlet. On the back of the pedestal is mounted a ¾ H.P. 3,600 R.P.M. motor driven exhaust unit fitted with a dust collecting bag. The net weight of the above machine is 846 pounds.

The arrangement is said to eliminate the necessity of installing an elaborate exhaust system, and to provide a complete assembled unit in itself.

Stoneware Fume Exhauster

U. S. Stoneware Company, 50 Church Street, New York City, offers a newly designed chemical stoneware fume exhauster, low pressure type, in three sizes: 3, 4 and 6 inch. The equipment is suitable for removal of corrosive fumes in plants performing such operations as plating, chemical processing, chemical handling, etc.

The exhauster, known as No. 639, has the following features, according to the maker. Incorrodable chemical stoneware parts for all contact with gases, protected by outer cast iron armor; silent operation; minimum vibration; non-clogging impellers as standard, or sirocco type on specification; four-jaw clamp attachment of impellers to shafts; exhauster discharge which can be swung through 360° and locked at any angle; provision for semi-flexible pipe connections; motor removable without disassembling housing; B & S pipe connections as standard, and flanged connections on specification.

The three sizes are made in two types, one with direct motor drive, one with belt drive.

Seamless Flexible Tubing

A new development in flexible metal tubing is announced by the American Metal Hose Company, Waterbury, Conn. The new product provides flexible tubing of either steel or brass, produced from solid drawn tubes by a new process. The tubing is for uses similar to those to which ordinary flexible metal tubing is put. It differs, however, in that the latter generally is produced from strip metal which is profiled and then wound on a mandrel together with packing to make the joints tight. The new "American" product eliminates the possibility of leaks, and is said to provide high pressure strength without seams, joints, welds, brazes or packing. It is made by machining solid tubing to give it deep helical corrugations. The tubing is stated to be all metal, flexible, resilient and leak proof. It will convey liquids or gases at high or low pressures.

The new type of tubing may be had plain or wound with wire braid, the latter type providing extra strength. It is also made in closed-grooved or open-grooved style; that is, without or with spaces between the helical corrugations; and both types are available plain or braided. Special couplings are available in soldered, welded or packed types, according to requirements of service; unless otherwise specified couplings are provided with American standard pipe threads.

The bending capacity of the tubing ranges from a minimum of 5 inches in diameter of bend for ⅛ in. tubing, to 30 inches for tubing of 2 in. diameter. With single braid the tubing has bursting pressure capacity ranging from 5,000 lbs. per square inch for the smaller diameters down to 1,000 lbs. per square inch for the largest.

Placement Bureau

American Trade Association Executives, 45 East 17th Street, New York City, offers a voluntary placement bureau service, without cost to employer or employee. It states that qualified executives are available for trade association management; commercial general management; sales promotion and marketing; advertising ond publicity; industrial analysis and research; expense analysis and standardization.

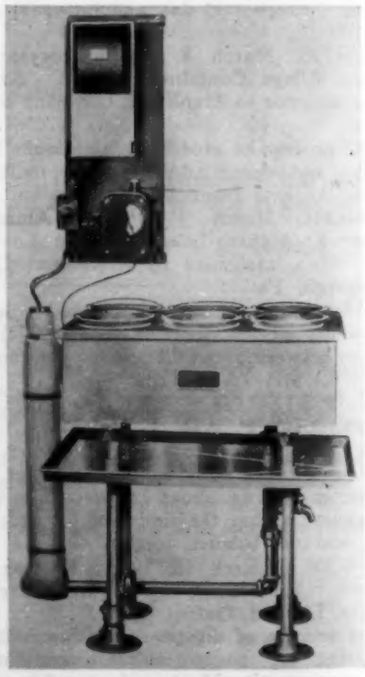
Electric Glue Heater

A thermostatically controlled electric glue heater which maintains constant temperature of glue within 2° F. is offered to the polishing industry by the Divine Brothers Company, Utica, N. Y. This is an addition to the line of thermostatically controlled steam and gas fired heaters already made by this company.

In addition to its close heat regulation, electric heater is highly efficient, it is stated. Tests show that over 90% of the heat evolved is absorbed by the glue. The heater is rapid in action. A test on a six-pot, four quart heater, starting with a water bath temperature of 60° F., showed a rise of slightly over one degree per minute, so that the time required for preparation of glue is materially reduced.

The heater is economical in use of electric current. After the glue has reached its correct temperature of 135 degrees Fahr., the current is automatically cut off, and remains off until the temperature of the bath has dropped 2 degrees, usually an interval of 8 to 10 minutes. The current then automatically flows for about two minutes to bring the bath back to normal temperature, when it is again cut off.

A time control can be supplied if desired. This will switch on the electric current at any time for which it may be set, insuring that glue will be melted and ready for use



New Glue Heater.

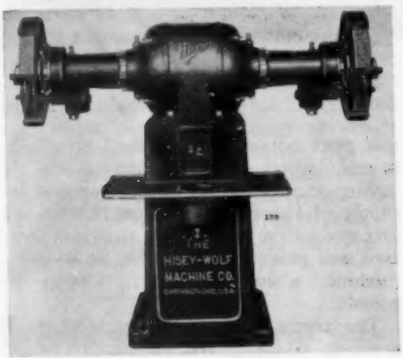
at starting time in the morning, without dependence on a watchman or other person to have glue ready for work without delay. The bath is filled with cold water at quitting time, the glue pots with the glue soaking in cold water are placed in the bath, and the time control set. At the proper hour the time control will switch on the current to have the glue melted when needed.

This heater is made with 4, 6, or 8 pots, the pot capacity being 2, 3, 4, 6, or 8 quart, as desired in each type.

Wide Swing Type Grinders

A new series of grinders suitable for large work such as stove and furnace castings, has been placed on the market by the Hisey-Wolf Machine Company, Cincinnati, Ohio. The new type of machine is known as the "Wide Swing" grinder. It is designed to provide ample room for handling large or irregularly shaped work.

The machine in general is equipped with the usual Hisey-Wolf features, including enclosed, dust proof motor having guaranteed ability to develop rated horsepower in continuous service, with temperature rise not exceeding 40° C. Standards of A. I. E. E. govern motor construction. Motors are available in single as well as two and three phase, alternating current; and for direct current. Other features include high grade ball bearings; suitable lubrication



New Hisey-Wolf Grinder.

system; motor starter and switch equipment conforming to E. P. C. recommendations; inspection covers for full view and access while machine is in operation; and grinding wheels selected especially to suit the work for which the machine is designed.

Welding Rod

Under the trade name of "Regorod," The Bastian-Blessing Company, Chicago, Ill., recently introduced a new line of welding rods and electrodes to be sold through a nation-wide organization of distributors.

A new "Regorod" catalog is available free on request. It is prepared in pocket size and gives a complete description of each type of rod and much information in reference to use in specific applications, a number of valuable tables for the use of the welder and welding engineer, etc.

Aluminum-Manganese-Magnesium Alloy

By DOUGLAS B. HOBBS

Aluminum Company of America, Pittsburgh, Pa.

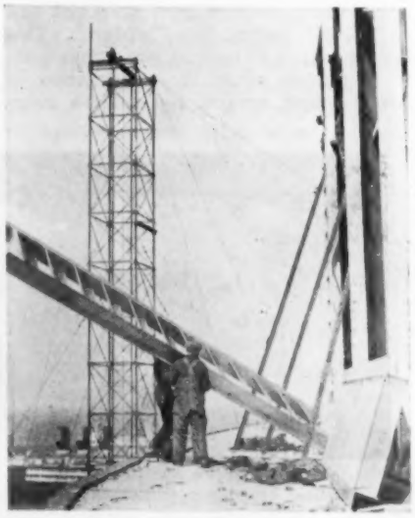
The sheet metal work on the Cleveland Municipal Stadium and the superstructures of ten 70-ton hopper cars for the Alcoa Ore Company are fabricated from a new aluminum manganese-magnesium alloy developed in Aluminum Research Laboratories. While these two applications for the alloy represent the largest single uses to date, the alloy has found wide acceptance because of its unusual combination of strength and corrosion resisting qualities.

The alloy, known as 4S,* was designed primarily to bridge the gap in physical properties between the common alloys and the strong aluminum alloys, thus rounding out the series of alloys produced by the Aluminum Company of America. For some time, there has been a need for such an alloy with properties intermediate to those found at both ends of this series. Alloy 4S not only supplies the desired physical properties, but combines, in a measure, the outstanding characteristics of both the common alloys and the strong alloys. Commercially pure aluminum, 2S, and the aluminum-manganese alloy, 3S, are known to possess high corrosion resistance and excellent workability, while the strong aluminum alloys have the strength of structural steel, but weigh only one-third as much.

Alloy 4S, which contains about one per cent each of manganese and magnesium, has the equivalent corrosion resisting qualities of 2S and 3S and but slightly inferior forming characteristics. It has far better workability than the strong alloys, yet approaches them in strength, although, strictly speaking, it may be classed as a medium strength alloy. Like the common alloys, it is not susceptible to heat treatment but is hardened by cold working. It is available in the annealed temper, in the full hard temper and in the intermediate tempers, and is marketed in all the forms in which the other standard aluminum alloys can be obtained.

*Alloy 4S contains about 1% each of manganese and magnesium. It is covered by U. S. Patent No. 1,797,851, dated March 24, 1931.

The tensile and mechanical properties of 4S alloy in the annealed, quarter, half, three-quarter and full hard tempers are given in Tables 1 and 2. The compression



Erecting one of the louvre panels in the upper course, Cleveland Municipal Stadium. These panels, fabricated from 4S alloy sheet, are 18 ft. 9 in. long by 6 ft. wide. They weigh but 65 lb. each.

strength and compressive yield point are similar to the tensile strength and tensile yield point. The endurance limit of the alloy is exceptionally high (14,000-16,000 lb. per sq. in., depending upon the temper), thus making possible many applications for 4S alloy in which vibration is an important factor.

TABLE I—TENSILE PROPERTIES OF 4S ALLOY

Temper	Tensile Strength Lbs. Per Sq. In.	Yield Point[1] Lbs. Per Sq. In.	Elongation % in 2 In.
Annealed	26,000	10,000	20
¼ Hard	31,000	25,000	6
½ Hard	35,000	31,000	5
¾ Hard	39,000	35,000	3
Hard	42,000	38,000	3

[1]Yield point is the stress at which the stress-strain curve shows a departure of 0.2% from the initial modulus line produced.

TABLE II—MISCELLANEOUS MECHANICAL PROPERTIES OF 4S ALLOY

Temper	Hardness Brinell[1]	Hardness Shore[2]	Shear Strength[3] Lbs. Per Sq. In.	Min. Bend Diameter[4]
Annealed	45	14	16,000	OT
¼ Hard	55	21	17,000	1T
½ Hard	65	23	19,000	2T
¾ Hard	73	26	21,000	4T
Hard	80	30	22,000	Difficult to bend.

[1]500 kg. load on 10 mm. ball.
[2]Magnifier hammer.
[3]Single shear strength values obtained from double shear tests.
[4]Diameter over which specimen will bend 180° without failure. T = thickness of specimen.

Bearings That Lubricate Themselves

By DONALD A. CLARK

Amplex Manufacturing Company, Detroit, Mich.

More mechanical units fail due to lack of oil than for all other reasons combined. This condition has existed since the first shaft was encased in a bearing, and has given birth to many attempts to find a method of making bearings that would not require oiling. In later years there have been several types of "oil-less" bearings placed on the market, of various degrees of efficiency.

A bearing has now been developed that is "oil-full" rather than "oil-less." This bearing carries its own oil, and automatically to provide oil at the proper time, in just the right amount, and oils the entire bearing surface. This bearing is being manufactured by the Amplex Manufacturing Company, 7900 Jos. Campau Avenue, Detroit, Mich., and is called by the trade name of "Oilite." Amplex is a division of Chrysler Corporation. "Oilite" was developed through experiments to discover a method of making a bearing that could be used in those places where no one ever puts enough oil—in the shackle pin bushings, king pin bushings of an automobile, and so on. The experimental engineers succeeded in producing a bushing that, while seemingly solid, actually contains from 30 to 35 per cent of oil by volume. All that is needed to produce the oil on the surface of the bushing is heat or pressure, producing enough for lubrication never enough to drip.

The "Oilite" bearing is made from pure virgin copper in the powdered form, to which are added tin and graphite. The copper is powdered to such fine grain that all of it can be passed through a 100-mesh screen and a large part of it will pass through a 300-mesh screen. The materials are weighed out according to formula and briquetted under a pressure of 50,000 lbs. per square inch. The briquette is strong enough to stand normal handling, but no pressure. It is then given a special heat treatment under which the briquette changes characteristics and color, and is transformed from a mechanical mixture to a bronze.

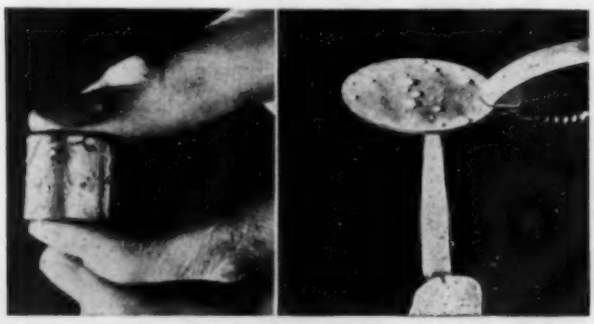
After the bearing has been heat-treated, instead of being weak and fragile it is tough and ductile, but porous enough to hold 30 to 35 per cent of liquid by volume, which may be anything from kerosene to "600W" oil. The porosity does not prevent the bearing from approaching the strength of a cast bronze bushing of equivalent dimensions, in addition to which it has both oil and graphite content.

The porosity of the bushing is demonstrated by holding a finger over one end of the bushing, filling it with water, and then applying pressure to the water with the thumb. Water and oil will come through the wall of the bushing. If the bushing is squeezed in a vise, a thick coating of oil will rise on the surface, which demonstrates that if the bearing is subjected to a load or pressure, lubrication is immediately supplied to relieve friction and carry off heat. At the same time the bushing will withstand a unit pressure of possibly 4,000 to 6,000 pounds before it will reach the point of failure; and 6,000 pounds is more pressure than a bushing will have to withstand in use in the average piece of machinery. The manner in which the "Oilite" bushing responds to the application of heat can be demonstrated by holding a lighted match against the bushing. A film of oil will immediately appear on the surface.

An experimental break-down test was made recently in order to obtain a comparison between steel bearings and "Oilite" bearings for automotive propeller shafts. The steel bearings failed in from 30 minutes to 8 hours. "Oilite" bearings stood up for 150 hours under exactly the same conditions. To determine shock-resistant properties, engineers set up a steering gear and arranged an eccentric weight so that an impact load could be applied to the cross shaft. A total load of 25,100 pounds was applied at a speed of 800 r.p.m. on a bearing area of less than four inches. This load was sufficient to break the housing within a short time. In a duplicate test with the housing strengthened, the worm and segment gear failed. In no case did the shaft or "Oilite" bushings show any wear or scores.

"Oilite" bearings have been adopted as standard for use in 80 places in the 8-cylinder Chrysler automobiles.

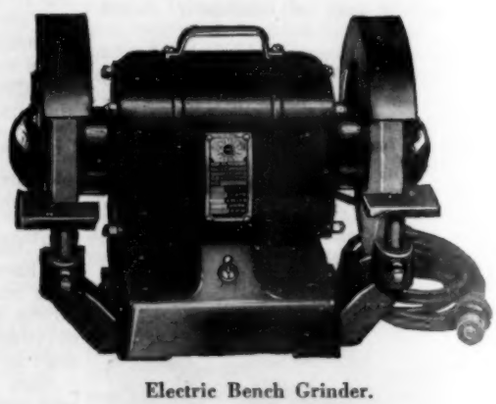
The Amplex Manufacturing Company seems to have been successful in developing a mechanical accessory for which there has existed a great need.



Left—"Oilite" bushing filled with water and pressed tightly between thumb and finger. Layer of oil is forced to surface of bushing. Right—"Oilite" spring disc held over a flame. Heat causes oil to come to surface.

"Premier" Bench Grinder

An improved bench grinder is offered by the Sunlight Electrical Manufacturing Company, Warren, Ohio. This is the "Premier" machine, which the maker states is a ball-bearing equipment suitable for small shops or factories where small, heavy-duty equipment is desired. The machine is driven by an 8-inch, ⅓ hp. motor, said to be able to pull ½ hp. continuously if necessary. Other specifications include tool rests adjustable for wheel wear; approved wheel guards; applicability to buffing or polishing by removal of guards; supply of two 8-inch grinding wheels, one fine, one coarse; convenient switch in base; cord and plug; strong handle for carrying machine when necessary; weight, 60 pounds.



Electric Bench Grinder.

The company manufactures other small grinding, polishing and combination finishing machines, as well as a variety of motors and other electrical equipment.

Electrolytic Sheet Copper

Raritan Copper Works, Perth Amboy, N. J., a subsidiary of Anaconda, announces that after extensive research it has developed a commercial method of producing sheet copper directly by electrolysis, in widths up to 30 inches, and in all reasonable lengths, the production method being continuous. Sheet up to 48 inches wide will shortly be available also, and wider sheets will be produced later as demand arises. The sheets produced at present are made in a variety of thicknesses, from 0.0017 in., weighing 1 oz. per square foot, up to 7 oz. per square foot. It is stated that rolling is probably more economical for sheets thicker than the 7 oz. weight.

The announcement states the process has been perfected to eliminate pinholes or other imperfections completely, even in the 1 oz. sheets. The process consists, briefly,

of electrodeposition from a pure acid copper sulphate solutions on hard lead cathodes which revolve slowly, and are partly submerged in the electrolyte. The deposited sheet is automatically stripped from the drumlike cathode as it emerges, being coiled on a spool after a water spray washes it. Automatic control of current density and speed of cathode rotation regulate the thickness of the sheet produced, up to 2 oz. weight. Control of gage thickness tolerances is said to be easier than in rolling. Sheets heavier than 2 oz. are produced by passing the continuous sheet through a second electrolyte equipped with soluble copper anodes. Here the sheets pass into one end of the bath and are looped in and out over wooden rollers above and below the anodes.

The material produced is stated to be finding a use in wrapping oil and gas pipe lines to prevent corrosion and soil stress; and for wrapping oil refinery pipe line insulation. Uses being developed include roofing, for which the sheets may be backed with fabric; for vertical surface covering; automobile tops.

The material is shipped in rolls on mandrels. It is marketed by the American Brass Company.

Aluminum Protective Paint

Aluminum Industries, Inc., Cincinnati, Ohio, has placed on the market "Permite Resalum," an aluminum protective coating material for which certain remarkable properties are claimed by the manufacturer. It is stated that the material is made with a base of "Albron" pigment produced by the Aluminum Company of America. It is said to provide a continuous coating of protective aluminum for metals, wood, fabric, stone or combinations of these materials. High heat resistance, corrosion resistance, protection from weather, good light reflection and economy are given as its chief features.

Blowpipes for Natural Gas

Numerous localities throughout the United States are changing over from manufactured to natural gas, which means new blowpipes, burners, etc., are needed

New Torit Blowpipe.

in plants. The change to satisfactory apparatus is not simple, as there appears to be great variation in the natural gases supplied. For this reason manufacturers of apparatus, as well as gas users, are having trouble.

The Torit Manufacturing Company, 171 West 3rd Street, St. Paul, Minn., have done considerable experimenting and now offer a blowpipe which they claim will give good results on any grade of natural gas, together with compressed air. This blowpipe is made in various sizes for different kinds of work.

Farrel-Sykes Gears

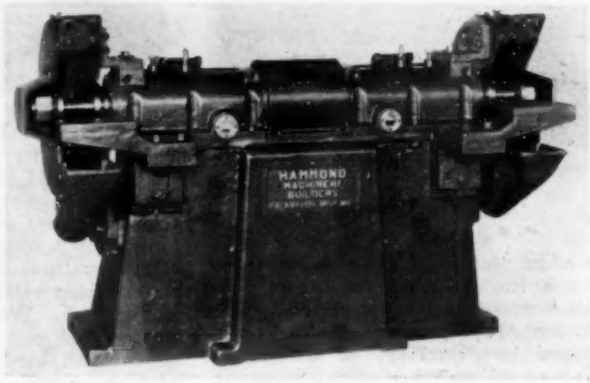
Farrel-Birmingham Company, Inc., Ansonia, Conn., announces that spur, single helical and double helical gears as large as 22 feet in diameter and as small as three inches in diameter, will be produced by means of a new gear generating machine the company has built. The Farrel-Sykes gears are widely used in the rolling mill industry. The new gear generator is one of the world's largest, and provides a means of producing gears of extreme precision, it is stated.

New 2-Spindle Grinder

Hammond Machinery Builders, Inc., Kalamazoo, Mich., has placed on the market a newly developed high speed, 2-spindle grinder with independent spindle control. It was developed to meet the needs of steel and malleable iron foundries and other large production plants requiring efficient rough grinding and snagging equipment.

The maker states that either bakelite or rubber bonded wheels operating at surface speed of 9,000 feet per minute can be used with the machine, as well as vitrified wheels operating at 6,000 feet. The machine is said to be highly economical as compared with equipment hitherto used, due to increased speeds made possible by large spindle and bearings, exceptional strength of materials and quality of workmanship. The spindles are fully independent, each having separate motor, drive, starter, spindle lock, etc. Operators work independently of each other.

By use of the Hammond patented variable speed pulley, it is stated, these machines can be equipped to maintain constant wheel periphery speeds throughout life of wheels, down to scrap size, it is stated. Protection against running large wheels at excessive speeds is provided.



New Hammond Double-Spindle Grinder for Heavy Work.

Equipment and Supply Catalogs

Stainless Steel Motor. The Lincoln Electric Company, Cleveland, Ohio. Bulletin on "Linc-Weld" Type E, totally enclosed, fan cooled induction motor.

Chemical Patent Litigation. American Cyanamid Company, 535 Fifth Avenue, New York. Reprint of court decision in The General Chemical Company v. The Selden Company, relating to sulphuric acid manufacture.

Aluminum Store Fixtures. British Aluminum Company, Adelaide House, King William Street, London, E. C. 4, England. "Aluminum in Shopfitting."

Cadmium Plating. Udylite Process Company, 3939 Bellevue Avenue, Detroit, Mich. "More than a Pound," an interesting Booklet explaining the company's operations, facilities and other things pertaining to the "Udylite" cadmium plating process. Illustrated.

Capacitor Motors. The Ideal Electric and Manufacturing Company, Mansfield, Ohio. Bulletin 210 on Noel polyphase capacitor motors. Full engineering data. Illustrated.

Welded Construction. Lukenweld, Inc., Coatesville, Pa. Illustrated bulletin describing a new manufacturing method.

Instruments. The Esterline-Angus Company, Indianapolis, Ind. Illustrated bulletin on graphic meters, etc.

Chemicals. J. T. Baker Chemical Company, Phillipsburg, N. J. Complete catalog and price list, June, 1932; 146 pages. Plating and finishing, laboratory and technical chemicals.

Air Valve. Briggs and Stratton Corporation, Milwaukee, Wis. Bulletin on a new type of valve for control of compressed air, said to be leak-proof.

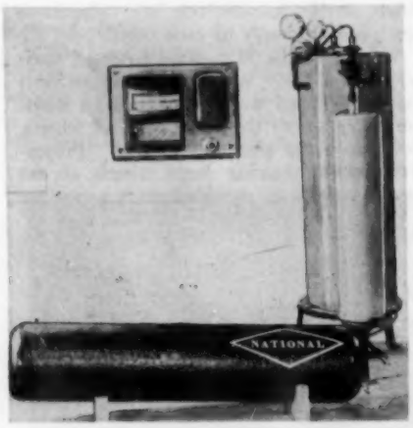
Arc-Welding. Harnishfeger Corporation, Milwaukee, Wis. Bulletin: "The Novice Understands and the Expert Appreciates."

Material Handling. Mercer Engineering Works, Inc., New York; Lucian C. Brown Company, 50 Church Street, New York, sales representatives. Bulletin 41 on heavy duty trucks, skids, etc.

General Electric Company, Schnectady, N. Y., publications: Magnetic Switch; Welding Electrodes and Accessories; D-C Motors Type B; Single-stage Centrifugal Compressors for various applications including sand blasting, brass furnace blowers, annealing, ventilation, atomizing, filtering; D. C. Generators and Exciters.

New Source of Hydrogen and Nitrogen

Hydrogen and nitrogen, or a mixture of these gases, are used in many industrial processes which demand a reducing or inert atmosphere. Some processes employing such gases are atomic hydrogen welding, bright annealing of metals, reduction of metallic oxides, radio tube and lamp manufacture, nitrogen packed foodstuffs, lead burning, and many others. The cost of hydrogen or nitrogen in pressure cylinders



Ajax Gas Generator.

has added materially to the total process cost; it has prohibited the use of such gases in many industrial processes.

A method of producing hydrogen and nitrogen by "cracking" or dissociating anhydrous ammonia now offers a cheap and reliable source for obtaining these gases.

The illustration shows an electric ammonia dissociator developed by The Ajax Electric Company, Philadelphia, Pa. This apparatus yields a dry gas containing 75% hydrogen and 25% nitrogen. Due to the purity of the raw material (anhydrous ammonia) the gas produced is not contaminated with any hydrocarbons, oxygen, oil or sulphur, it is stated. A standard cylinder of 100 lbs. ammonia will yield 4,500 cu. ft. of dissociated gas. Based on an ammonia cost of 16c per pound, and a power rate of 2c per KWH, the cost of the dissociated gas is only $3.68 per 1,000 cu. ft. in an average size unit. Ajax is offering the dissociators in the following standard sizes: 50, 150, 300 and 500 cu. feet per hour capacity.

Large Gear Generator

One of the world's largest and most modern design of gear generator for generating continuous tooth herringbone, straight spur and single helical gears is now being installed at the Youngstown, Ohio, works of United Engineering and Foundry Company. It took a year to complete the machine, which will generate the well-known Sykes gear, noted for accuracy of tooth contour and division, and will complete United's equipment for producing any type of gear used in the rolling mill industry. The machine has a capacity up to 20-feet diameter, 60-inch face and 6-inch c. p. All United gear drives for cold mills will be fitted with this precision generated type of gear.

Monel Metal Forgings

As a result of recent developments in the forging of Monel metal rods, shafts, spindles, etc., in large diameters at the plant of The International Nickel Company at Huntington, West Va., it has been possible to further increase the range of physical properties of such material, the company reports. Engineers are now able to secure a uniform yield point in excess of 70,000 p.s.i., with an ultimate tensile strength over 90,000 p.s.i., on forged bars from 3 inches to 6 inches in diameter Elongation value averages higher than 25 per cent.

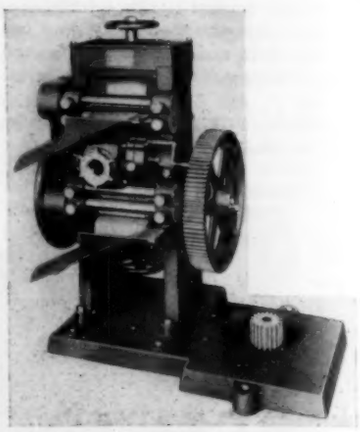
One of the first large forgings to show these properties was a propeller shaft 6 inches in diameter and 14 feet long, shown at the 1932 Motor Boat Show in New York, which was strong enough to lift a 310 foot Navy destroyer if it could be used vertically as a lifting bar.

Aluminum Welding Rod

Linde Air Products Company, 30 East 42nd Street, New York City, announces that both the Oxweld No. 14 drawn aluminum rod for welding sheet aluminum and the Oxweld No. 23 aluminum rod for welding cast and sheet aluminum and aluminum alloys are now available in the form of 10-lb coils of ⅛-in. diameter rod. Many users have found it advantageous to use aluminum welding rod in coil form for certain work. Waste from short ends is reduced, and under many conditions the operator can handle tightly wrapped coil more easily than a 36-in. straight length.

Stripper for Round or Oval Lead Covered Cable

John Robertson Company, 121 Water Street, Brooklyn, New York, has developed a machine for stripping round or oval lead covered cable of various sizes. Chief feature is the adjustable guide and splitting head which permits stripping a variety of sizes of cable. Insulation of the wire is protected by regulation of the depth of splitting knives. Cable is pushed into the machine for about two feet, after



Robertson Cable Stripper.

which it is pulled automatically. The machine cuts the removed lead covering into small pieces, suitable for remelting. Manufacturers of garden hose using the lead encasing process are said to be large users of this machine, besides the cable people.

Associations and Societies

Purchasing Agents

The 17th annual international convention and "Informa-Show" of the National Association of Purchasing Agents (address, 11 Park Place, New York City) was held at Detroit, Mich., June 6 and 7. Representatives of many industrial groups attended.

F. M. Ross, purchasing agent of the Consolidated Car-Heating Company, Albany, N. Y., presented a report of the American Foundrymen's Association's recommendations for buyers of castings. C. C. Snyder of the Republic Iron and Steel Company, Youngstown, Ohio, gave an address on "New Developments in Stainless Metals." Prof. Earl S. Wolaver, of the School of Business Administration, University of Michigan, Ann Arbor, addressed the members of the Association's mining, smelting and refining group on the purchasing of service as compared with commodity purchases.

The Electrochemical Society

The Electrochemical Society will hold its autumn meeting at Cleveland, Ohio, September 22 to 24, inclusive. Headquarters will be the Hotel Cleveland. There will be ample opportunity for industrial visits, as Cleveland is a large center of electrochemical activity, as well as other commercial and scientific institutions of interest to the electrochemist. There will be sessions on electro-organic chemistry and photo-electricity. Manuscripts of papers for the meeting should be in the hands of the secretary by July 15.

Personals

W. J. Cook

W. J. Cook, widely known hot galvanizing (zincing) authority, celebrated his fiftieth anniversary as executive head of the hot galvanizing departments of the Wheeling Steel Corporation, Wheeling, W. Va., and predecessor companies, on March 15, 1932.

Mr. Cook was born at Staffordshire, England, the son of H. R. Cook, who came to this country in 1867 to establish the then comparatively new trade of hot galvanizing. The father, prior to coming to this country, had operated a galvanizing plant at Staffordshire for his parents, so that W. J. Cook represents the third generation of a family of galvanizers. H. R. Cook came to the United States to take charge of the Moorehead and McLain plant at Pittsburgh, the old Soho Works, which used to turn out the "Soho" brand of galvanized sheets. The elder Cook later went to Chicago to establish a galvanizing firm of his own. There W. J. Cook learned the business. It is of interest that his own son, Nelson E. Cook, is also a galvanizing man, being assistant manager of galvanizing for the Wheeling company. In fact, the Cook name in connection with galvanizing does not stop even there. Tom Cook, late brother of W. J. Cook, was for 30 years in charge of the U. S. Steel Corporation's galvanizing shop at Cambridge, Ohio. Another brother, E. B. Cook, set up the Arms Brothers galvanizing plant at Niles, Ohio, in 1891, and has since managed galvanizing shops in all parts of the country. Fred Cook, still another brother, has for about 30 years been head of the hot galvanizing of tubes for the Republic Steel Corporation, Youngstown, Ohio. Other relatives of W. J. Cook connected with hot galvanizing are Harry Cook, a brother, who was in this line for some years then took up other interests; Earl Cook, a nephew, now with American Sheet Steel Company, Ojibway, Ontario.

W. J. Cook, senior of all of these, arrived at Wheeling in 1882 to install and operate a hot zincing shop for the Whitaker Iron Company, sheet producers. During all successive changes, whereby the Whitaker Iron Company operations were taken over by the Whitaker-Glessner Company which also acquired the Burgess Iron and Steel Company, Portsmouth, Ohio, later known as the Portsmouth Steel Company, and twelve years ago merged with others to form the Wheeling Steel Corporation, W. J. Cook has continued on the same job. The beginning of his fifty-first year in the same position finds him actively at the helm of perhaps the oldest and largest group of galvanizing plants in the country, with apparently the same vigor and enthusiasm which marked the youthful galvanizer half a century ago when he fired the first pots for his employers. During his career, to date, he

W. J. COOK

has taken an important part in the development of the capacity of the first galvanizing shop in Wheeling from 3,500 tons in 1884 to the total of 350,000 tons, which was attained under Mr. Cook's management in 1929. Likewise, he shares with the Wheeling Steel Corporation the distinction of operating continuously for a half century the only galvanizing shops installed as early as 1882. No other shop or galvanizing business of the present time is known to have existed when Mr. Cook installed the plant at Wheeling in 1882. For this reason the Wheeling Steel Corporation is looked upon as the oldest galvanizer of sheets and formed products in America, and Mr. Cook the dean of all hot galvanizing experts.

Mr. Cook, with a fifty-year record behind him, has many active years ahead, if one may judge by his vitality. He takes pride in the many men who have graduated from his organization to assume charge of galvanizing shops in many parts of the country.

One of the charter stockholders of the Wheeling Corrugating Company, subsidiary of the Wheeling Steel Corporation, founded in 1890, W. J. Cook is also member of the present board of directors.

In a half century Mr. Cook has witnessed and had a large share in many changes and developments in hot galvanizing processes. In fact, his work has paralleled the history of the industry, and his contribution of improvements to method and processes as well as his unique record of fifty years' experience in galvanizing has established him as the leading practical authority in the business.

Benjamin F. Brusstar, for eight years a sales representative of the Baltimore Tube Company, Baltimore, Md., has entered business for himself. He will represent various companies in the sale of copper and brass products, with offices at Packard Building, 15th and Chestnut Streets, Philadelphia. Mr. Brusstar is widely known in the rolling mill industry, with which he has been connected for 40 years. Representing the Baltimore company, he was in the New England and Philadelphia territories.

Obituaries

Christian J. Hills

Christian J. Hills, president since 1899 of the Haydenville Company, brass manufacturers at Haydenville, Mass., died June 22, 1932, in his seventy-eighth year.

Mr. Hills was a native of Haydenville and spent nearly his entire life there. He became head of the brass concern when he purchased it in partnership with four brothers, of whom three have since died, and the fourth, Reuben B. Hills, is vice-president and treasurer of the company. Mr. Hills was a man of great capability, and his leadership was evident in the success of the company he headed. Several years before the Hills brothers acquired it, the firm's factory had been destroyed by flood. It was reorganized the year before they took it over, but Mr. Hills and his brothers really gave it the impetus which has kept it continuously successful.

Mr. Hills was regarded as Haydenville's leading citizen, taking active interest in many civic and social affairs.

Henry F. Cook

Henry Francis Cook, former silverware manufacturer, died at Sag Harbor, L. I., recently, in his 77th year. Mr. Cook had been with the silverware firm of Joseph Fahys and Company, New York City, from 1873 to 1930. He was board chairman up to the time of his death.

Seth E. Thomas

Seth E. Thomas, president of Seth Thomas Clock Company, Thomaston, Conn., died June 7, 1932, in his 56th year. He was also board chairman of the General Time Instruments Corporation, Thomaston.

Mr. Thomas was the fifth of his name connected with the Thomas Clock firm. He was a great-great-grandson of the original Seth Thomas. Born in New York City, he graduated from Yale in 1899. He began his business career with the family clock concern, became president in 1915.

He made his home at Morristown, N. J. His death occurred on a train while he was commuting to his office in New York.

Mr. Thomas is survived by his widow, the former Josephine van Beuren Reynolds, and two daughters.

Harry W. Abrams

Harry W. Abrams, member of the firm of Abrams Brothers, and vice-president and treasurer of the E. R. Caldwell and Son Brass Company, New York, died recently at a hospital in Washington, D. C., where he was residing at the time. He had been in failing health for some time.

George E. Wells

George E. Wells, for 25 years a member of the engineering department of the American Brass Company, Waterbury, Conn., was killed May 26, 1932, in an automobile accident.

William E. Poole

William E. Poole, former general superintendent of the New York Insulated Wire Company, Wallingford, Conn., died at that city, June 24, 1932. He was 69, and had been ill for several weeks. Mr. Poole retired from active service with the wire company last May. Besides his industrial activity, he was also a director of a bank and of the Chamber of Commerce of Wallingford. He is survived by his widow and three children, as well as two sisters.

Industrial and Financial News

Old European Pin Maker to Establish Plant Here

William Prym of America, Inc., subsidiary of the German house of William Prym, Inc., manufacturers of pins since 1450, will establish a plant for manufacture of straight and safety pins, needles, snap fasteners, thumb tacks, T-pins, key rings, etc., at Long Island City, N. Y., it is announced. The firm will be headed in this country by H. A. Prym, son of Hans Prym, head of the parent company in Germany.

The announcement points out that the 470 years of the Prym company's leadership in Continental pin manufacture is an indication of the integrity and sturdiness of the organization. Thirteen generations of the family have managed the company, which has withstood all the conditions of past four centuries. Originally a maker of brass pins, the company quickly adapted itself to the machine age when it came. Mass production in pin manufacture was introduced, and the "Sonomor" brand of steel articles, mostly plated, has since been made by ultra rapid machinery.

Aluminum Industries, Inc.

Bruce V. Keller has been appointed advertising manager of Aluminum Industries, Inc., Cincinnati, Ohio, succeeding R. C. Glandorf, who has been transferred to Chicago as assistant to O. E. Van Altena, Chicago district manager.

L. C. McCaskill, former assistant district manager at Kansas City, Mo., has been named district manager at Detroit, succeeding J. H. Gallegher, resigned.

The Philadelphia and New York districts have been combined as the eastern district, under supervision of R. F. Craig, New York, City, who now adds Maryland, Delaware, New Jersey and eastern Pennsylvania to the whole of New England which he has previously covered. J. P. Grimes, former district manager at Philadelphia has resigned.

C. L. Haugseth, catalog department head at St. Cloud, has been transferred to the home office at Cincinnati, where all catalog work is now done.

J. F. Christie, district manager for Permite Products of Canada, Ltd., now has supervision over entire British Columbia. The Canadian company is a subsidiary. R. E. McGill, western manager for Aluminum Industries, will devote his time to Pacific coast territory in the United States. Mr. Christie will continue his headquarters at Winnipeg.

Brass Ingot Statistics

Non-Ferrous Ingot Metal Institute, Chicago, Ill., reports the average prices per pound received by its membership on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight-day period ending June 17, as follows:

Commercial 80-10-10 (1% Impurities)	6.797c
Commercial 78%	5.250c
Commercial 81%	5.503c
Commercial 83%	5.700c
Commercial 85-5-5-5	6.017c
Commercial No. 1 Yellow	4.507c

Grand Rapids Metal Plants

Twenty-one metal manufacturing plants in the Grand Rapids, Mich., area supply a huge amount of materials to the automotive industry, according to a recent review in the Grand Rapids "Press." The city has more than 80 metal working plants employing in normal times from 12,000 to 15,000 persons. About 70 of the concerns are members of the Grand Rapids Metal Trades Association. Practically all kinds of nonferrous and ferrous metal working is done, many of the plants having numerous departments devoted to nearly all types of fabrication and finishing. Principal lines of manufacture other than of automotive products include refrigerators, nonferrous foundry work, metal refining, electroplating, musical instruments, hardware, ornamental metal work. There are 13 nonferrous foundries in the district.

Roy C. Blanchard

Roy C. Blanchard, 40, production engineer of the Grinding Machine Division of Norton Company, Worcester, Mass., died June 29 following an operation. A graduate of Worcester Polytechnic Institute, he had been with the company for 16 years.

Bandits Take $25,000 in Precious Metals

Hold-up men entered the offices of Baker and Company at 30 Church Street, New York City, on June 21 and robbed the company of about $25,000 worth of precious metals, in which the firm, which has headquarters at Newark, N. J., deals. The loss is believed to be covered by insurance. Investigation of the crime has thus far elicited no clues, according to Baker and Company officials.

This is the third precious metals robbery in New York in recent weeks. Last month we reported robberies at the establishments of the Dental Gold Manufacturing Company, Brooklyn, and Moe Hammerschlag, Inc., Manhattan.

Lower Aluminum Alloy Duty

Report of an investigation of the United States tariff on imports of certain aluminum alloys was last month approved by President Hoover and the rate of duty was decreased from 5 cents to 2½ cents per pound on the following: alsimin, ferrosilicon aluminum and ferroaluminum containing 20%, but not over 52% of aluminum. No change was made in tariffs on other grades of these alloys, or on silicon aluminum or aluminum silicon. The alloys on which the tariff was lowered are used in steel deoxidization. No change occurred in alloys used chiefly in nonferrous metallurgy.

American Cyanamid

American Cyanamid Company announces that, effective July 1, 1932, American Cyanamid and Chemical Corporation, 535 Fifth Avenue, New York City, a wholly owned subsidiary, will consolidate the activities formerly carried on by the following subsidiaries: American Cyanamid Sales Company, The Kalbfleisch Corporation, A. Klipstein and Company, Inc., Kalbfleisch Bauxite Company, Inc., Fumigators Supply Company, Superior Chemical Company, Inc., John C. Wiarda and Company, Inc.

Activities of American Cyanamid Company in industrial and heavy chemicals will

be merged with those of American Cyanamid and Chemical Corporation. American Cyanamid Company will continue to handle fertilizer materials and mining chemicals as in the past.

In addition, the activities of the following companies will at the same time be placed under the control of American Cyanamid and Chemical Corporation: American Powder Company, The Selden Company, Structural Gypsum Corporation, Owl Fumigating Corporation, The Kalbfleisch Corporation of Surinam (Dutch Guiana).

Officers of American Cyanamid and Chemical Corporation are: W. B. Bell, chairman of board; H. L. Derby, president; K. F. Cooper, vice-president in charge of manufacture; P. M. Dinkins, vice president in charge of sales; R. C. Gaugler, treasurer; A. B. Savage, assistant treasurer; W. P. Sturtevant, secretary; G. R. Martin, assistant secretary; K. E. Manning, assistant secretary.

Lincoln Arc Welding Prizes

Lt. Com. Homer N. Wallin and Lt. Henry A. Schade, both of the United States Navy and working in collaboration, won the $7,500 first prize in the second arc welding prize competition sponsored by The Lincoln Electric Company, Cleveland, Ohio. The $3,500 second prize was won by Major G. M. Barnes, United States Army. The third prize of $1,500 went to H. H. Tracy, structural engineer of the Southern California Edison Company, Ltd., of Los Angeles. A $750 fourth award went to Gustav F. D. Wahl and Harry E. Johns, Kiel, Germany. H. J. L. Bruff of Harrowgate, England, won fifth prize of $500. An award of $250 went to William H. Zorn, Wyandotte, Michigan. Thirty-five additional prizes of $100 were awarded to other writers of papers.

Corporation Reports

STANLEY WORKS, New Britain, Conn., declared quarterly dividend of 25 cents payable July 1, record June 16, as compared with 37½ cents paid the previous quarter.

ANACONDA WIRE AND CABLE COMPANY, New York, reported net loss of $236,446 after charges for quarter ended March 31, 1932, against net profit of $161,465 for first quarter of 1931.

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

JULY 1, 1932.

Scovill Manufacturing Company has concluded negotiations with **Hookless Fastener Company,** makers of the "Talon" slide fastener, whereby Scovill becomes a joint distributor of the fastener. They will promote it actively, beginning at once in the garment industries. Scovill will sell in every state except California, Oregon, Washington, Idaho, Utah, Arizona and Nevada. Sales offices will be maintained at 280 Broadway, New York and in Chicago, Detroit and Atlanta, while the New England selling will proceed from Waterbury.

Scovill Manufacturing Company will work only five days a week until further orders. Under a new regulation a full day off is required Saturday with a slight reduction in pay to salaried and monthly-paid employees to make up for it. **John H. Goss,** vice-president, says the same result could be accomplished by disturbing the rate of pay but this had been decided against as the salaried and monthly-paid employes prefer to retain their standard of pay and have all of Saturday off than take a direct wage cut.

Scovill Manufacturing Company has declared the regular quarterly dividend of 37½ cents a share payable July 1 to stockholders of record June 15.

The bronze for the new Waterbury post office is being supplied by **American Brass Company.** The contract amounts to $33,000, but part of this is for setting up. It is understood that there will be in addition sculptured bronze panels for the interior which will amount to about $10,000.

John A. Coe, president of **American Brass Company,** spoke on "The Business Man's Philosophy of Life" at the 8th annual **Connecticut Industrial Conference** at Chester, Conn., last month. Plans were discussed for organizing a Connecticut industrial relations plan to improve the human factor in industrial plants. Representatives from this city included: Walter A. Jarvis, Patrick Whiston, William H. Graham, George Sengstacken, Walter F. Phelan, George Conlong and Charles E. Webber from the **Chase Companies;** William Carpenter from **Patent Button Company;** and Herman Koester, J. A. Harry Peterson and Loren S. Chase from **Bristol Company.** Other speakers were **George Reama** of **Winchester Arms Company** of New Haven; **George S. Hawley,** president of Bridgeport Manufacturers Association; **E. W. Christ,** vice-president, **Stanley Works,** New Britain; and **John William** of **Yale and Towne Company,** Stamford.

Eighty-six per cent of the common stock of **Beardsley and Wolcott Manufacturing Company** was at a special meeting last month to vote on the directors' recommendation that preferred stock be issued to replace the outstanding debenture issue. The recommendation was approved. All debenture owners have agreed to exchange debentures for preferred stock. Company is reported to have been operating at a small profit for the last several months, in contrast to operating at a loss last year. It will immediately issue $205,000 worth of 7% preferred stock to exchange for the debentures.

John H. Goss, vice-president **Scovill Manufacturing Company,** spoke at the annual meeting of the **Bridgeport Ordnance District.** Frederick H. Payne, assistant Secretary of War, and Brig. Gen. W. G. Tschappat, assistant chief of ordnance addressed the meeting. Others present: C. R. Burt, president, **Pratt and Whitney,** Hartford; C. C. Chesney, president, **General Electric Company;** P. B. Gale, board chairman, **Hartford Machine Screw Company;** Edwin Pugsley, **Winchester Repeating Arms Company,** New Haven; A. B. Reynders, **Westinghouse Electric Company;** S. M. Stone, president, **Colt's Patent Fire Arms Company** of Hartford, and W. R. Webster, board chairman, **Bridgeport Brass Company.**

Reports are prevalent that **American Brass Company,** subsidiary of Anaconda Copper Mining Company, has received a large increase in orders recently. It is claimed that actual bookings for the week ending April 18 were the best of any week this year, and about double the poundage rate of the two lowest months, April and May. Officials of the concern refuse to confirm this. Earlier it was reported the company had ordered more copper than ever before, on one day, according to the report, having ordered over 1,000,000 pounds. The reason for this, the report said, was to make the purchase before the new four cent tariff on copper went into effect. **Pres. John A. Coe** denied this, saying that the company is still buying only enough for requirements as they occur, that no amount out of the ordinary has been bought lately, and that the tariff had not caused any change in the method of buying. When later it was reported that its orders for fabricated products had greatly increased, no comment would be made by the local officials, who referred all inquiries to the officials of the Anaconda Copper Mining Company.

W. R. B.

Connecticut Notes

JULY 1, 1932.

NEW BRITAIN—American Hardware Company's $218,411 check was the larg-

est of any received for taxes last month. **Stanley Works'** $144,707 was next. **Landers, Frary and Clark** was third with $128,081. They will also pay in October as follows: American Hardware, $85,134; Stanley Works, $65,521; Landers, Frary and Clark, $52,347.

Stanley Works will build and install 10 self-opening doors in the new railroad station in Cincinnati. They will be equipped with "invisible eyes," which consist of a beam of light lying across the path of anyone approaching the door and which causes the door to swing open as the beam is broken.

THOMASTON—Vice-President Mason T. Adams of the **Seth Thomas Clock Company** denies reports that the plant will close for three months this summer. It is on a sharply curtailed schedule. Several veteran employes have been released and others shifted to positions of lesser importance. It has also been decided to cease payment of pensions to a number of former employes. Its office staff has been much reduced.

Plume and Atwood Company is working only two days a week in most departments, and some employes are working only one day a week. The salaried staff has received three cuts in pay, first one of about $25 a month, then a 10% cut, and now an 8% cut.

BRIDGEPORT—Remington Arms is employing more people and doing more business than it has for several years, several departments working until 8 p. m. daily, and some late on Saturdays. It is reported to be producing about 90,000,000 rounds of ammunition for sporting guns. **W. A. Tobler,** general manager, says enactment of federal tax on shells resulted in unusual demand from distributors for shells to be sent them before June 21. After that it is probable the demand will ease off and some departments will have to take a vacation.

W. A. Tobler, vice-president and general manager of Remington, charged that the "present inquisition" of the **Federal Trade Commission** into five ammunition companies in connection with the now defunct **Ammunition Manufacturers Association** is "unpatriotic." He said this in testifying at the hearings concerning formation of the association in 1929, when he was president of the **Winchester Arms Company,** which, he said, was "facing bankruptcy." The government claims that three companies, the **United States Cartridge Company,** the **Peters Cartridge Company,** and the **Western Cartridge Company,** restrained competition by fixing uniform prices, etc. Mr. Tobler said "ours is a stricken industry," and that the question of national defense should be borne in mind. In case of war, unless producing facilities are maintained during peace times, the government will be "up against it," he said.

MIDDLETOWN—Russell Manufacturing Company has filed petition for receivership. Its current assets, consisting chiefly of inventories, are set at $2,000,000, and bank loans amount to $615,000. To meet the maturities the company would be forced to sacrifice on inventories. The present figure of bank loans has been reduced from $1,500,000 as of Nov. 30, 1929. The real estate is valued at $2,114,536. Company patents and good will are set at only $2. Net quick assets are valued at $91.37 a share, based on the company's statement of November 30 last, and amount to $1,827,314.

MERIDEN—International Silver Company declared quarterly dividend of $1 on preferred shares, payable July 1, record June 14. Same amount was paid three months ago.

STAMFORD—Yale and Towne Manufacturing Company declared dividend of 25 cents on common stock, payable July 1, record June 10. Similar dividends were paid the two previous quarters.

W. R. B.

Western Massachusetts

JULY 1, 1932.

Although for the 26 metal working establishments in Western Massachusetts the total number of men employed has fallen off slightly, several concerns have started to rehire some of the employes released during the last month.

Business in the magneto division of **United American Bosch Company** has been somewhat on the upgrade, and the prospects are good for the coming month. Comparatively heavy orders are being received from the automotive industry, and the company has called back several hundred former employes.

Westinghouse activities have been somewhat on the upgrade. Business last month was even greater than was anticipated after the enactment of the sales tax. Orders are still holding up fairly well, although plant officials expect a letdown in the near future.

Moore Drop Forge Company has found it necessary to recall some former employes because of increased demand from **Ford Motor Company.** At present the plant is running on a three shift schedule, and it probably will continue for some time.

During the past few weeks there has been a slight spurt in business in the automotive tool division of the Van **Norman Machine and Tool Company.** The same is true at the **Baush Machine Tool Company.**

Business has picked up slightly at the **Cheney Bigelow** wire plant and at the **Package Machinery Company,** but officials are not prone to believe that the recovery, such as it is, is a permanent condition.

Relatively heavy orders have come to the **Central Specialties Company** in Westfield, and the management is anticipating no immediate break in business.

Throughout the district it is estimated that from 65 to 70 per cent of the workers normally employed are now working. Business men feel in general that there will be a slight pickup in the early fall but are not extremely optimistic over the outlook for the summer months.

G. B. Y.

Middle Atlantic States

Central New York

JULY 1, 1932.

Business in the metal trades in Utica showed a slight upward curve in past month, but in Rome, center of the copper and brass business of this area, the graph of business activities slipped steadily downward.

The impetus given some businesses by the passage of the United States revenue act, which went into effect June 21, showed little if any reflex in the Central New York area, a survey by the Industrial Association of Utica revealed.

George L. Brunner, general manager of the **Brunner Manufacturing Company,** Utica, has returned from England, where he contracted for production of his company's line of air compressors with **Thomas W. Ward and Company,** Sheffield. Mr. Brunner said he found an unfavorable market for American made products in England.

Evan James, who for 40 years was in the employ of the **Rome Brass and Copper Company** as stationary engineer, was congratulated on his 99th birthday at a dinner given by his friends in Rome June 13.

Some of the employees of the **Utica Cutlery Company** went on strike over wages June 18. The matter was settled between workers and employers later.

E. K. B.

Newark, New Jersey

JULY 1, 1932.

Baker and Company, refiners and manufacturers of precious metals, 54 Austin Street, has let a contract for a new sweeps building at 110 Murray Street. The new plant will be used for reducing and salvaging precious metal sweeps and other waste. The building will cost $40,000 with equipment.

Two buildings at Hamilton and Liberty Streets have been sold to **Venino Brothers and Company, Inc.,** dealers in electric motors, generators, wiring, etc. The buildings are three and four stories and comprise 25,600 square feet.

United Color and Pigment Company, Inc., Evergreen Avenue, has let a contract for a building to cost $40,000. The structure will be two stories.

Titanium Pigment Company, 60 John Street, New York, has let a contract for three buildings, machine shop, warehouse and welfare structure, at South Amboy, N. J., to cost $2,000,000. The plant will be erected on an 88 acre site.

Warner Chemical Company, Carteret, N. J., will rebuild a two story factory building on Roosevelt Avenue to cost $50,000.

Eggens Hambler Company., Inc., has been incorporated to manufacture fountain pens with 200 shares common stock capitalization.

C. A. L.

Trenton, New Jersey

JULY 1, 1932.

The huge plant of **J. L. Mott Company, Inc.,** was sold recently to four bondholders holding a $1,235,000 first mortgage. They made the only bid, and bought the factory for $25,000. The sale was later confirmed by the Federal Court at Trenton. Any other purchaser would have had to meet the million and a quarter first mortgage price first, and then bid in competition to the bondholders. **J. D. Orr,** second vice-president of the **Guarantee Trust Company,** New York, was the bidder. The others are Mrs. Andrew Carnegie, Bank of Manhattan Trust Company and the National City Bank, New York. The sale means the end of the Mott Company, at one time one of the world's largest manufacturers of sanitary plumbing equipment. The factory, comprising a dozen large buildings with floor space of 22,000 acres, will be offered for sale or rent. The plant was one time valued at $5,000,000.

A reorganization committee representing the **Laib Pottery Company,** Louisville, Ky., bought the Mott stocks and property in a Federal Court sale here in 1927 with a price of $1,650,000. The Mott company failed early in 1927, when the late Federal Judge Rellstab ordered the plant's sale unless a mortgage of $2,000,000 held by the Guarantee Trust Company was met. The company was unable to rehabilitate its finances and the mortgage was foreclosed.

J. Phillip Bird, Plainfield, N. J., was re-elected president of the **Manufacturers' Association of New Jersey.** He enters upon his twenty-first year in the office. Other officers elected were **J. W. Ferguson,** Paterson, vice-president; **William F. Birch,** Dover, second vice-president; **Harry D. Leavitt,** Trenton, treasurer; and **W. C. Billman,** Trenton, secretary.

A complaint of the **Federated Metals Corporation,** Trenton, N. J., against freight rates on zinc by-products has been dismissed by the Interstate Commerce Commission at Washington. The commission held that rates from points in Canada to Trenton were not unreasonable. The recommendations of a commission examiner were reversed in the decision of the commission. The metals company held that the Pennsylvania Railroad Company was a party to excessive joint rates over railroads operating in this country and Canada. The company sought reparation for past shipments. These were denied in the commission's decision. C. A. L.

Middle Western States — Pacific Coast

Detroit, Michigan

JULY 1, 1932.

Conditions in the metal lines in this area are quiet, and nothing particularly encouraging is in view for the immediate future. In fact, not many are expecting much during the summer months, and perhaps not until after the presidential election.

Most of the plants, if operating at all, are still on part time. Even the motor car companies, with perhaps one exception, are sliding back. Manufacturers of refrigeration units are in a somewhat better position than most of the others. Some maintain fairly normal production, while others would like to do much more.

Plating plants, like many others, are doing very little. Some are practically at a standstill, while a few are operating on part time. Producers of plumbing and building hardware are simply marking time and hoping for the best.

Lansing Electrotyping Company, 230 North Washington Street, Lansing, was recently incorporated. Capital stock is $15,000; **Ernest A. Hawkes,** principal stockholder.

Emerald Corporation, Adrian, Mich., has started production on a new type of small electric motor and an electric pump jack. Its payroll is now double that of a few weeks ago. **L. B. Kuney** is president.

Sterling Cable Corporation, a new Michigan concern, is reported about to get into production at Port Huron, Mich. It will produce rubber-covered wire in a portion of the building of the **American Enameled Magnet Wire Corporation.** It is a subsidiary of the **Electric Auto-Lite Company,** which is said to be interested in several other plants in the Port Huron area.

O. E. Laechelt, for the past five years with the **Bunting Brass and Bronze Company,** Toledo, recently joined the sales department of the **Detroit Seamless Steel Tube Company.**

J. Seaton Gray and **LeRoy Woodland** have been named receivers for the **Fuller and Sons Manufacturing Company,** Kalamazoo, Mich., auto parts makers, on petition of the directors, it is stated. Assets are listed as $1,600,000 and debts $419,186.

Hammond Aircraft Corporation, Ann Arbor, was recently organized with 10,000 no par shares of stock.

General offices and the manufacturing facilities of the **Mallory Electric Corporation,** have been moved from Toledo to Detroit, at Vancouver Avenue and the Pere Marquette Railroad. This company manufactures automobile ignition equipment. **M. Mallory** is president and **J. G. Hodgson** general manager.

F. J. H.

Wisconsin Notes

JULY 1, 1932.

Considerable progress in the manufacture of aluminum and bronze work since his firm entered the field is reported by **W. C. Schmelling,** general manager of the **Badger Wire and Iron Works,** Milwaukee. Orders now on the books will keep the company busy for the next four months, he said. The plant employs about 60 men and is working full time. The company recently shipped two large ornamental white bronze eagles that will adorn the entrance to the new Harrison County court house at Wheeling, W. Va.

A new air valve has been announced by **Briggs and Stratton Corporation,** Milwaukee. The valve supplies automatic, intermittent control of compressed air blasts for ejecting work, keeping dies and tools clean, etc. It is used on punch presses and other machine tools where drilling, broaching, reaming and similar operations require controlled compressed air blasts.

John J. Van Dreese, salesman for the **Aluminum Goods Manufacturing Company,** Manitowoc, has been transferred to eastern territory, with headquarters at Buffalo. W. T. N.

Los Angeles, Calif.

JULY 1, 1932.

William Benbow, 1605 South Arlington Avenue, claims to have perfected a process for applying metallic oxides to porcelain, which he claims has been a lost art since the sixteenth century. Benbow says he worked 23 years to perfect it, and he keeps it secret. He is a maker of Sheffield plate. He states in reference to the porcelain decorating process that the porcelain is fired at 2200°-2500° F., to produce a glaze of great durability. He uses platinum, gold, silver, bismuth, cobalt and other metals. He claims he can produce almost any color, and he defies detection as to his method.

Mohlaire Sales Company has established a factory at 1401 South Los Angeles Street, to produce air conditioning equipment for homes, hospitals, schools, etc. The device is a metal box containing water supplied by a connection, with a fan. It is connected to the light socket, can be easily moved about.

Homer V. Philps has established salesroom at 942 South Hope Street for **Art Metal Construction Company,** James town, N. Y. He has 20,000 sq. ft. of space, serves California, Nevada, Arizona, New Mexico.

Fred S. Renauld Company, New Orleans engineering specialists, have removed to Los Angeles, and established offices at 124 W. 4th Street. Firm acts as consultant to the metal and marine lines.

Lake Manufacturing Company, making signaling equipment, has removed from this city to 2323 Chestnut Street, Oakland, Calif., where it now has its plant.

Elizabeth Hurt, 1275 Third Avenue, makes toy metal furniture.

Westport Manufacturing Company, 1477 West Adams Street, is making radios.

Inventive Engineering Company, 209 West 18th Street, is manufacturing all types of galvanized and aluminum propellers.

Neubart Manufacturing Company, metal spinners and stampers, has established at 16th Street and Maple Avenue. Principals are **Andrew Neubart,** formerly with Metallite Company, and **Guy Bartholomew.** A retinning plant has been set up.

L. O. Rubber Stamp Company, Los Angeles, has greatly expanded its business in silver cups and trophies. The coming Olympic Games has created considerable new demand for this type of product.

Welch Company has established a plant at 2433 Hunter Street to make brass spray guns.

Central Machine Company, 140 South Los Angeles Street, is making a metal tire inflator.

International Nickel Company, New York, has an extensive exhibition of Monel metal at the Architects Building.

Ideal Steel Drawer Slide Corporation has bought a building at 757 West Venice Boulevard. They plan to produce 40,000 sets of slides daily, to be distributed in 102 cities, and estimate first year's output at $1,000,000; 50 men will be employed. **C. L. Wilquin** and **J. Parker Thompson** head the firm.

E. F. Krause and Company, wire products distributors, 809 Yale Street, has started wire manufacture, for which equipment has been installed.

Artistic Sign Company has taken larger quarters at 5539 Sunset Boulevard.

Purex Chemical Company, A. C. Pelletier, president, has a new plant at 1001 E. 62nd Street. Firm is working 16 hours a day; has another plant at East St. Louis.

Phelps Dodge Copper products Corporation, whose local branch is known as **Inca Manufacturing Company,** has moved the local factory to 2375 E. 27th Street. **R. A. Connor** is local manager.

Dale, Roberts and Company has started making metal toys and novelties at 1305 S. Union Avenue. Die castings are used.

Other Pacific Coast Items

Morris Refrigerator Company, 262 Eighth Street, San Francisco, Calif., has started manufacturing refrigerators. Morris Langfelder is manager.

State Prison at Boise, Idaho, will install $1,000 worth of machinery for manufacture of auto license plates and other enamel ware by prison labor.

Shibley Company, Mount Vernon, Wash., will manufacture water filters.

Valley Foundry, 710 H Street, Fresno, Calif., is making plant alterations.

Otto E. Schroeber, Point Firmin Hill, San Pedro Harbor, Calif., operating a secret alloy formula, reports a steadily expanding business in lead toys, says he has used up two tons of lead for about 2,000,000 toys. H. S.

Other Countries

Birmingham, England

JUNE 20, 1932.

There has been further weakening of the copper market, with lower prices for strong copper sheet and copper and brass pipe. Like many other Midlands industries the non-ferrous trade is having difficulty to keep going. Export trade offers few opportunities, and manufacturers have to rely mainly on domestic specifications. General trade has not shown improvement, and unemployment figures show an increase.

Sales of builders' brass foundry have continued very moderate. Outdoor programs were curtailed by bad weather and flooding. Before manufacturers feel any benefit from increased consumption, sales will have to show considerable improvement as distributors are heavily burdened. An encouraging feature in retail sales is a recovery in hardware. A larger turnover is shown in each of the districts for which returns are available, but particularly in London and Scotland. Engineering and shipbuilding continue depressed, and consequently are making small demand on the metal working branches. Nevertheless there was a slight increase of activity in the comparison of the first quarter of the year with the last quarter of 1931.

The automobile industry is maintaining activity at a reasonable rate for the time of year, but some of the big factories in this district are on short time schedules. Orders to makers of metal castings have been somewhat restricted, but this has been the most regular consuming branch.

The aluminum hollow ware trade has had to face medical propaganda discouraging the sale of cooking utensils. The British Hollow Ware Association has had the subject examined by experts in the medical world and the Chairman will shortly make a statement with a view to explaining inaccurate reports. It is believed, however, that a good deal of harm has been done in the way of curtailing retail sales.

In recent years the number of firms producing aluminum hollow ware has increased at a rapid rate, and price-cutting has been a general complaint. The public, however, have been encouraged to buy kettles, saucepans, etc., in a reasonably heavy gauge. The cast iron hollow ware makers, to meet the competition from aluminum, have looked around for means of increasing their business and have discovered new processes for finishing iron utensils. One firm has a process which gives the articles a tinned interior and vitreous enamelled exterior. The same firm evolved the idea of reducing heat wastage, and to achieve this certain articles are given a completely enamelled interior and a vitreous enamelled exterior, but the surface which comes into contact with the flame or hot plate is left bare.

J. A. H.

Business Items — Verified

National Engineering Company, 549 West Washington Boulevard, Chicago, Ill., has appointed **Lester B. Knight, Jr.,** as sales manager. Company makes foundry equipment.

F. W. Wakefield Brass Company, Vermillion, Ohio, will build a new plant wing to increase floor space by 20%, and will considerably alter the present facilities, according to **A. F. Wakefield,** vice-president and general manager. He states the firm has considerable new business and in prospect requiring new and more rapid production methods. Company operates tool room, cutting-up, stamping, brazing, polishing and lacquering departments. First quarter business this year was best in the last five quarters, it was reported, with plant operating overtime frequently.

Louis Lowenstein, Inc., scrap dealer and maker of secondary ingots, 56-60 Water Street, Brooklyn, N. Y., has changed its name to Lowenstein Metals Corporation. Company is a buyer of all grades of nonferrous scrap; states it is in the market for a portable shear to cut round material about 1½" in diameter.

Columbia Electric Manufacturing Company, 1292 East 53rd Street, Cleveland, Ohio, has recently appointed **William L. Shively** sales engineer of the electro-chemical division, which handles a full line of plating and polishing equipment and supplies.

United Iron and Metal Company, scrap firm of Pittsburgh, Pa., has moved its offices to its own building at 9th and Bingham Streets. This firm handles metals and scrap iron.

Federated Metals Corporation has removed its Boston, Mass., office from 200 Summer Street to the Consolidated Building, 250 Stuart Street. **M. M. Levy** is district manager.

Specialty Brass Company, Inc., Kenosha, Wis., recently celebrated its twenty-fifth anniversary with a special program at the plant.

Rupert Diecasting and Stamping Corporation, Cleveland Avenue and Seventeenth Street, Kansas City, Mo., recently removed to that location, will equip additional floor space with machinery. The following departments are operated: casting shop, stamping. This firm is interested in a draw press to make a tub 18" high, 34" diameter, 18 ga. steel; also dies for drawing same.

H. Kramer and Company, Chicago, Ill., manufacturers of brass and bronze ingots, white metals and special alloys, have announced that **Charles R. Hilb,** 909 Provident Bank Building, Cincinnati, Ohio, has recently become connected

with them. The firm does smelting and refining.

H. M. Pickard Company, Livonia, N. Y., manufacturer of wood and metal trunks for automobiles and other luggage equipment, has been purchased by a group of local business men. The firm will be reorganized and incorporated as the **Livonia Manufacturing Company.** Machinery, equipment and raw materials will be removed from Avoca to Livonia, where operations will be resumed in modern quarters within a few weeks. The following departments are operated: tinning, soldering, lacquering and japanning.

Virginia Lead Smelting Corporation, Norfolk, Va., has made several changes in personnel. **C. A. Geatty,** formerly assistant manager at the Baltimore branch of National Lead Company, is now manager at the Virginia plant, replacing **M. T. Nichols,** who resigned; **C. Haan** of the comptroller's department of the Atlantic branch has been appointed assistant treasurer; **A. C. Shaw** of the Matawan plant is now superintendent there. This firm operates a smelting and refining department.

Liquid Metal Laboratories, Inc., has changed location of its principal business office to 844 Rush Street, Chicago, Ill., and changed its name to **Liquid Solder, Ltd.** Correspondent: L. B. Lincoln, 53 W. Jackson Boulevard. This firm operates the following departments: soldering, lacquering, japanning.

Metal Specialties Company, a new Buffalo, N. Y., corporation, has leased the building formerly occupied by the Rustless Rule Company at 9 Lafayette Avenue. The building, with approximately 4500 sq. ft., will be used for the manufacture of parts for moving picture machines. The following departments are operated: aluminum foundry, casting shop, stamping, polishing.

Chandelier Art Metal Company, Watertown, Wis., has been organized by **H. W. Vore** and **F. Ehrensperger,** to manufacture lighting fixtures, grille and wrought metal work. The plant is being established at 200 First Street. The following departments will be operated: brass machine shop, soldering, spinning, brazing, plating, polishing, lacquering.

Norton Company, Worcester, Mass., announces the following changes in sales organization became effective July 1. **Wallace T. Montague,** with Norton for twenty years, became the director of sales, Abrasive Products Divisions, handling sale of abrasive grain, Norton floors, refractories and laboratory ware and pulpstones. **H. K. Clark,** relinquishing management of the Chicago branch, became director of sales of the Grinding Wheel Division, with headquarters at Worcester. **W. E. Shumway** moves from Hartford, Conn., where he was district manager, to become manager of the Chicago branch of the Grinding Wheel Division. His work in Connecticut will be carried on by **O. A. Nierendorf** and **R. W. Price. William Pettigrew,** transferred from the research laboratories, has joined the Abrasive Grain Division as sales engineer.

Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

Copper

JULY 1, 1932.

Action of the copper market particularly in domestic circles, was quiet and steady during the past month. In the export section, where the trading turnover had also fallen off some weeks ago to narrow proportions, there was a slightly larger volume of business lately.

The market has made little noticeable response to the tariff on copper which went into effect on June 21. Conservative interests are inclined to look for some stimulus to trade from this new regulation later on particularly as the price of copper has had a drastic drop since the beginning of the year. The provisions of the tax bill just passed by Congress, include refunding of import tax or duty, on copper in various forms. This refund is conditioned on the exportation of the article on which the tax is paid, after such article has been refined or used in the process of manufacture of an article exported.

Market prices ruled steady for the entire month, and quote 5⅜ cents delivered terms.

Zinc

With buying demand again at low level, prices worked moderately lower to 2.80 cents East St. Louis and 3.17 New York. On this basis sales recently were narrow. The general apathy of buyers was followed by some rumors of price shading indicating that pressure to sell was originating in quarters anxious to overcome reluctance of buyers in booking new business.

At the close of month, the trend of prices was downward, and sales of prime western brands were reported at as low as 2.75c East St. Louis delivery.

Tin

The fluctuations in tin in the past month were sufficiently wide to show that this market is still subject to erratic movements. Prices were at their best at the beginning of the month, with prompt Straits tin 20.75 cents and firm at that. In a little over a week, however, there was a severe slump at London and New York which sent the price down to 18.65 cents. The suspension of a prominent firm operating in London caused a sensation in trade circles. It was reported that this firm had large outstanding commitments on tin, but the formation of a pool to take over these holdings and dispose of them was apparently able to prevent panicky conditions. Definite market improvement occurred in the last half of the month. Prompt Straits tin was up more than a cent per pound. The tin industry appears determined to carry out plans for heavy curtailment of production this year. On the basis of approved restriction schemes and quota rates there will be a reduction of output that will put the statistical and market position of tin in better shape.

Lead

The undertone in the lead market continued steady throughout June. Opening prices and closing quotations were the same, and on the basis of 2.90c East St. Louis and 3c New York there was a moderate demand with occasional large purchases. There was an increase in output and a falling off in shipments in May as compared with the previous month.

Cable and battery industries and white lead makers took large shipments. Deliveries to cable makers for the first five months of this year are less than half what they were for the corresponding period of 1931. Shipments to ammunition makers have also fallen off more than half.

Aluminum

With the trading demand and consumption of aluminum below normal, prices of primary aluminum hold steady. This firmness has been a conspicuous feature in this market for a long time. The leading producer is applying scientific and industrial research methods successfully to increase the use of this metal. New manufacturing uses are being introduced thus opening up profitable sales territory in new fields. Concessions for remelt and secondary grades were necessary to effect sales. Supplies of this material, however, are always subject to negotiation.

Antimony

Trading in antimony was on a restricted scale lately and has been at the expense of prices. Chinese regulus is down to 5 cents duty paid, a decline of 2 cents per pound since February. There have been no developments for several weeks to stimulate buying interest. Chinese production has undergone a decrease during the last two years. Stocks in Far East showed an increase lately. Market has been listless for sometime past, with tendency to drift toward lower levels.

Quicksilver

Current prices of Quicksilver both here and abroad have come down sharply. The sagging tendency of the market was more pronounced in the last half of June. Prices range from $56 to $57 per flask. Present prices are lowest in ten years.

Platinum

An easier tone prevails in market for refined platinum, with quotations of $34 to $37 per ounce.

Silver

There was little in recent developments to stimulate interest in the market action

of silver. Late in June the price of bar silver weakened and touched 26¾ cents, the low point of the year thus far. There has been much talk of placing silver and gold on a ratio as a basis for international credits. As the world gold supply totals but eleven billions of dollars some sound and adequate measures appear necessary to broaden and strengthen the economic and financial structure among the various nations of the world. It is claimed that the depressed price is not due to an overproduction of silver in the United States or other countries, but chiefly to an excess supply derived from the debasement and melting up of silver coins and the sale of metal therefrom in the markets of the world. A large part of this supply has come from India. United action is necessary to stabilize silver at higher levels.

Old Metals

The scrap and secondary metal markets were comparatvely quiet lately. Expectations of firmer conditions were entertained when the adoption of the copper tariff went into effect. Developments since, however, show consumers apathetic and hard to interest. A considerable tonnage of copper and brass scrap was taken for export. European buyers realize prices are abnormally low and have taken advantage of several attractive offers lately. At the same time offerings have been equal to requirements. The entire trade await new developments with keen interest, and lean to the opinion that price lists have been shaded to what ought to mark the minimum for many future years.

The Wrought Metal Business

By J. J. WHITEHEAD

President, Whitehead Metal Products Company of New York, Inc.

JULY 1, 1932.

There is a feeling prevalent that we have seen the worst, that the bottom of the depression has been touched or passed. Certainly from current levels no one could expect things to get much worse without complete chaos resulting.

Under date of June 21 The American Brass Company issued a statement that deserves careful study and thought: "Actual bookings of the American Brass Company for the week ended June 18th were the heaviest for any week this year, and about double in poundage the rate for the two lowest months, April and May . . . Bookings were largely made up of small orders and covered a very general line.

"Officials . . . expressed the opinion that the increase was due to the realization by buyers that they could not expect any lower price for copper and were obliged to replenish stocks which were exhausted."

Provided following weeks continue to show gain it would seem now is high time to provide for future wants. Certainly with copper so very low, and with no indication of its going lower, it would seem to be the part of wisdom to take care of at least a part of one's future requirements.

Recently at the convention of the National Association of Master Plumbers at New York the exhibition of products demonstrated the importance of nonferrous metals in that field. There were copper tubing and boilers for water service and plumbing; for oil lines and irrigation; sprinkler lines, conduit, etc. This explains why the copper tubing business has held up so well. The show also featured Monel metal sinks, hot water tanks, tops for tables, stoves, wash tubs, washing machines, etc.

Aluminum is also pushing ahead, developing new products.

At the moment no great tonnages are being sold, but the outlook is getting better and better. It is almost certain that the near future will show a marked improvement.

Commodity prices seem to be holding up or advancing slightly.

Daily Metal Prices for the Month of June, 1932

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	6	7	8	9	10	13	14	15	16	17
Copper c/lb. Duty Free													
Lake (Del.)	5.50	5.375	5.625	5.625	5.625	5.625	5.625	5.625	5.625	5.625	5.50	5.50	5.50
Electrolytic (f.a.s. N. Y.)	5.25	5.25	5.375	5.375	5.375	5.375	5.375	5.375	5.375	5.375	5.375	5.375	5.25
Casting (f.o.b. ref.)	5.00	5.00	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.125	5.125	5.125
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	2.85	2.85	2.825	2.825	2.825	2.825	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Brass Special	2.95	2.95	2.925	2.925	2.925	2.925	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Tin (f.o.b. N. Y.) c/lb. Duty Free													
Straits	20.75	20.50	20.625	20.00	19.80	19.625	18.65	19.50	19.70	19.125	19.30	19.25	19.50
Pig 99%	19.875	19.625	19.90	19.375	19.00	18.85	18.00	18.75	19.00	18.375	18.55	18.50	18.75
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Aluminum c/lb. Duty 4c/lb	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Electrolytic 99.9%	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	36	36	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	40	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb	5.125	5.125	5.125	5.125	5.125	5.125	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Silver c/oz. Troy Duty Free	28.125	27.75	27.875	28.00	27.875	27.875	27.75	27.625	27.75	27.75	27.625	27.625	27.50
Platinum $/oz. Troy Duty Free	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

	20	21	22	23	24	27	28	29	30	High	Low	Aver.
Copper c/lb. Duty Free												
Lake (Del.)	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.625	5.375	5.540
Electrolytic (f.a.s. N. Y.)	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.375	5.25	5.307
Casting (f.o.b. ref.)	5.125	5.125	5.125	5.125	5.125	5.125	5.125	5.125	5.125	5.25	5.00	5.159
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	2.80	2.80	2.80	2.75	2.75	2.75	2.75	2.75	2.70	2.85	2.70	2.791
Brass Special	2.90	2.90	2.90	2.85	2.85	2.85	2.85	2.85	2.80	2.95	2.80	2.893
Tin (f.o.b. N. Y.) c/lb. Duty Free												
Straits	19.40	19.60	19.70	19.55	19.35	19.20	19.00	19.60	20.25	20.75	18.65	19.635
Pig 99%	18.65	18.85	19.00	18.75	18.50	18.35	18.25	18.75	19.375	19.90	18.00	18.865
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.60	2.90	2.60	2.886
Aluminum c/lb. Duty 4c/lb	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.												
Electrolytic 99.9%	35	35	35	35	35	35	35	35	35	35	35	35
Shot (from remelted electroylic)	36	36	36	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.125	5.00	5.034
Silver c/oz. Troy Duty Free	27.375	27.375	27.375	27.125	26.75	26.75	26.75	26.75	26.625	28.125	26.625	27.455
Platinum $/oz. Troy Duty Free	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

Metal Prices, July 5, 1932

(Duties mentioned refer to U. S. tariffs on imports, as given in the Tariff Act of 1930.)

NEW METALS

Copper: Lake, 5.50. Electrolytic, 5.25. Casting, 5.125.
Zinc: Prime Western, 2.65. Brass Special, 2.75.
Tin: Straits, 24.40. Pig, 99%, 19.50.
Lead: 2.60. Aluminum, 23.30. Antimony, 5.00.
Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flash, 75 lbs., $57. **Bismuth,** 85.
Cadmium, 55. **Cobalt,** 97%, $2.50. **Silver,** oz., Troy (N. Y.) official price July 6, 26.125.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $34.00 to $40.00.

Duties: Copper, free; zinc, 1¼c. lb.; tin, free; lead, 2½c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	Duty
Brass Ingots, Yellow	4½ to 6½	45%
Brass Ingots, Red	6 to 7¼	45%
Bronze Ingots	7 to 9½	45%
Aluminum Casting Alloys	19 to 22	4c. lb.
Manganese Bronze Castings	18 to 35	45%
Manganese Bronze Ingots	6 to 10	45%
Manganese Bronze Forgings	26 to 35	45%
Manganese Copper, 30%	17 to 25	25%
Monel Metal Shot or Blocks	28	25%
Phosphor Bronze Ingots	7¼ to 10	45%
Phosphor Copper, guaranteed 15%	9¾ to 15	3c. lb.
Phosphor Copper, guaranteed 10%	9½ to 14	3c. lb.
Phosphor Tin, no guarantee	26 to 38	Free
Silicon Copper, 10%	17 to 35	45%
Iridium Platinum, 5%	$39.00	Free
Iridium Platinum, 10%	$40.00	Free

OLD METALS

Dealers' buying prices, wholesale quantities	Cents lb.	Duty
Heavy copper and wire, mixed	3⅜ to 3⅝	Free
Light copper	2⅞ to 3⅛	Free
Heavy yellow brass	1⅝ to 1¾	Free
Light brass	1⅛ to 1⅜	Free
No. 1 composition	2½ to 2¾	Free
Composition turnings	2⅜ to 2½	Free
Heavy soft lead	2 to 2¼	2½c. lb.
Old zinc	1 to 1¼	1½c. lb.
New zinc clips	1⅜ to 1⅝	1½c. lb.
Aluminum clips (new, soft)	9 to 10	4c. lb.
Scrap aluminum, cast, mixed	2½ to 2¾	4c. lb.
Scrap aluminum sheet (old)	6 to 7	4c. lb.
No. 1 pewter	11½ to 12	Free
Electrotype and stereotype	1⅞ to 2	2½c. lb.*
Nickel anodes	20¼ to 22¼	10%
Nickel sheet clips; rod ends (new)	23¼ to 24¼	10%
Monel scrap	6 to 9	3c. lb.

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, small quantity, packing, etc., as shown in manufacturers' price lists, effective May 19, 1932.

COPPER MATERIAL

	Net base per lb.	Duty
Sheet, hot rolled	14⅞c.	2½c. lb.
Bare wire	8c.	25%
Seamless tubing	14⅜c.	7c. lb.
Soldering coppers	15⅜c.	45%

NICKEL SILVER (NICKELENE)

Net base prices per lb. (Duty 30% ad valorem.)

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	20½c.	10% Quality	23⅝c.
15% Quality	22¾c.	15% Quality	27⅝c.
18% Quality	24c.	18% Quality	31⅛c.

BRASS MATERIAL—MILL SHIPMENTS

Net base prices per pound

Net per lb.	High Brass	Low Brass	Bronze	Duty
Sheet	12c.	13⅛c.	13½c.	4c. lb.
Wire	12c.	13⅛c.	13½c.	25%
Rod	9¾c.	13⅛c.	13½c.	4c. lb.
Open seam tubing	19¾c.		21¼c.	25%
Angles, channels	19¾c.		21¼c.	12c. lb.
Seamless tubing	15¼c.		16⅝c.	8c. lb.

TOBIN BRONZE AND MUNTZ METAL

Net base prices per pound. (Duty 4c. lb.)	
Tobin Bronze Rod	13½c.
Muntz or Yellow Metal Sheathing (14"x18")	14⅛c.
Muntz or Yellow Rectangular sheet other sheathing	14⅛c.
Muntz or Yellow Metal Rod	10¾c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.30
Aluminum coils, 24 ga., base price	30.00

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (July 6) 29.50c. per Troy oz. upward according to quantity. (Duty free.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.00	2c. lb.
Zinc sheet, full casks (jobbers' price)	9.25	2c. lb.
Zinc sheet, open casks (jobbers' price)	10.00 to 10.25	2c. lb.
Full Lead Sheet (base price)	6.25	2½c. lb.
Cut Lead Sheet (base price)	6.50	2½c. lb.

BLOCK TIN AND BRITANNIA METAL SHEET

(Duty free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs or over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Lighter gauges command "extras" over the above prices.

Supply Prices, July 5, 1932

ANODES

Copper: Cast	17¼c. per lb.	**Nickel:** 90-92%	40c. to 45c. per lb.
Rolled, sheets, trimmed	15¾c. per lb.	95-97%	42c. to 46c. per lb.
Rolled, oval	14 c. per lb.	99% cast, 44c. to 48c.; rolled, depolarized, 45c. to 49c.	
Brass: Cast	16¼c. per lb.	**Silver:** Rolled silver anodes .999 fine were quoted July 6 from 29.50c., per Troy ounce upward, depending upon quantity.	
Zinc: Cast	09 c. per lb.		

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$3.00/lb.	$2.75/lb.	$2.65/lb.
10-12-14 & 16	2 to 3½	3.00	2.70	2.50
6-8 & over 16	1 to 3½	3.10	2.85	2.70-2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 to 6	¼ to 3	4.85	4.85	4.85
4 to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

On grey Mexican wheels deduct 10c. per lb. from White Spanish.

COTTON BUFFS

Full disc open buffs, per 100 sections, when purchased in lots of 100 or less:

11" 20 ply 64/68 Unbleached	$13.37	to	$13.80
14" 20 ply 64/68 Unbleached	21.60	to	22.65
11" 20 ply 80/92 Unbleached	17.00	to	17.55
14" 20 ply 80/92 Unbleached	26.37	to	28.00
11" 20 ply 84/92 Unbleached	21.69	to	21.90
14" 20 ply 84/92 Unbleached	35.37	to	36.15
11" 20 ply 80/84 Unbleached	21.69	to	21.90
14" 20 ply 80/84 Unbleached	35.37	to	36.15

Sewed Pieced Buffs, per lb., bleached ..... 41c. to 70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.09¾-.14
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.04½-.05
Chromic, 75 to 400 lb. drums	lb.	.13 -.17½
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06-.06½
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	11.30-18.00
Denatured drums	gal.	.436
Alum—Lump, barrels	lb.	.03¼-.04
Powdered, barrels	lb.	.03½-.04
Ammonia, agua, 26 deg., drums, carboys	lb.	.02¾-.05
Ammonium sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide	lb.	.28-.37
Arsenic, white, kegs	lb.	.04½-.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax, granular, 99½+%, ton lots	lb.	.02¼-.02¾
Cadmium oxide, 50 to 1,000 lbs.	lb.	.55
Calcium Carbonate (Precipitated Chalk)	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.08
Chrome Green, bbls.	lb.	.19
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.14-.20
Cyanide (100 lb. kgs.)	lb.	.39
Sulphate, bbls.	lb.	.038-.05¼
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluorspar, f.o.b., carload lots	ton	$17.50-32.00
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.32-.34
Iron Sulphate (Copperas), bbls.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, 100% synth., drums	gal.	.41½
Nickel—Carbonate, dry bbls.	lb.	.32
Chloride, bbls.	lb.	.18
Salts, single, 300 lb. bbls.	lb.	.10½-.13
Salts, double, 425 lb. bbls.	lb.	.10½-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.06¾-.08½
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 96-98%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.50
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.04½-.05¾
Silver Chloride, dry, 100 oz. lots	oz.	.25 -.27½
Cyanide (fluctuating)	oz.	.33 -.40
Nitrate, 100 ounce lots	oz.	.21¾-.23¾
Soda Ash, 58%, bbls.	lb.	.023
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.16½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate	lb.	.05-.06¼
Nitrate, tech., bbls.	lb.	.03¼-.07
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.01½
Stannate	lb.	.20½
Sulphocyanide	lb.	.30 -.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.25½-.27
Tripoli, powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, drums, bbls.	lb.	.07½-.10
Cyanide (100 lb. kegs)	lb.	.38
Sulphate, bbls.	lb.	.03½